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3.0 Affected Environment

3.1 Affected Environment

The Affected Environment section addresses the natural and human resources potentially affected by the Project. This section of the Environmental Report is developed on various data sources, which include aerial photography, US Geological Survey (USGS) topographic maps, National Wetland Inventory (NWI) maps, publicly available databases, GIS files downloaded from the appropriate resource-based information system, data requested from federal and state agencies for the Project area, and data collected during field surveys initiated in 2008. These data were compiled, quantified, and evaluated for this Environmental Report.

For the Steele City Segment, field surveys for cultural resources, biological resources, Water of the US, and wetland delineations were completed where access was granted by landowner through August 2008 and will continue in 2009. Protocols for field surveys were submitted to various federal and state agencies for review and approval (See Appendices F and G). Final field survey reports are included in Appendices F and G. Information gathered from these surveys has been incorporated into this Environmental Report and will also be used in completing permit applications. Additional surveys for re-routed areas, more detailed cultural resource investigations and follow-up spring surveys for listed species will take place in early 2009.

For the Gulf Coast Segment and Houston Lateral, field surveys for cultural resources, biological resources, Waters of the US, and wetland delineations were completed where access was granted through August 2008 in the summer of 2008. Protocols for field surveys were submitted to various federal and state agencies for review and approval (See Appendices F and G). Final field survey reports are included as Appendices F and G. Information gathered from these surveys has been incorporated into this Environmental Report and will also be used in completing permit applications. Follow-on surveys for re-route areas, more detailed cultural resource investigations and follow-up spring surveys for listed species will take place in early 2009.

3.1.1 Humid Subtropical Climate

The humid subtropical climate can be found in the southeastern United States and is noted for its warm summer months and relatively mild winters. The east coast location of the humid subtropical climate places it near the source region for maritime tropical air. Additionally, warm ocean currents paralleling these coasts further enhance the instability of the air. These factors combine to produce moderate amounts of precipitation in most months of the year. The humid subtropical climate is subject to cold temperatures during the winter as air masses embedded in cyclonic storms pass through this region. The high humidity experienced in the humid subtropical climate makes warm days feel oppressive. The daily temperature range tends to be very small as the evening does not cool down much during the summer. Beaumont, Texas, located at approximately 30° latitude, lies in the humid subtropical climate. Beaumont, Texas, has an average maximum annual temperature of 78.1°F and an average minimum annual temperature of 59.2°F. The Steele City tank farm and Part of the Gulf Coast Segment and all of the Houston Lateral are in the humid subtropical climate.

3.1.2 Air Quality Regulatory Requirements

As discussed in Section 3.2.3, Project facilities will be subject to the following federal and state air quality regulations implementing the federal Clean Air Act (CAA) of 1970 and its amendments. A more detailed discussion is provided in Section 3.2.3. The Clean Air Act, 42 USC 7401 et seq. as amended in 1977 and 1990 is the basic federal statute governing air pollution. The potentially relevant provisions of the CAA to this Project are listed below and discussed in the following subsections:

- National Ambient Air Quality Standards (NAAQS);
- Prevention of Significant Deterioration (PSD);

- New Source Review (NSR);
- Greenhouse Gases (GHG);
- New Source Performance Standards (NSPS);
- National Emission Standards for Hazardous Air Pollutants (NESHAP); and
- Title V Operating Permits.

The Project will also be subject to air quality regulatory programs in Nebraska (discussed in Section 3.2.2.7).

3.2 Climate and Air Quality

The climate and air quality section in this Environmental Report describes the regional climate and meteorological conditions that influence transport and dispersion of air pollutants and discusses the existing levels of criteria air pollutants in the Project region. Applicable federal and state (Nebraska) air quality regulatory programs are discussed. This section also presents a summary of the emissions from the proposed facilities in the Steele City Segment and new pump stations on the Keystone Cushing Extension, the Gulf Coast Segment, and the Houston Lateral.

Construction emissions will occur during the construction of the proposed pipeline. Operational emissions will be limited to the proposed pump stations to be located along the pipeline and the tank farm to be located near Steele City, Nebraska. The proposed pump stations are to be electrically driven, with power supplied by local electric utilities. The pump stations will not include a source of backup power supply; therefore, operational emissions from each of the pump stations will consist only of fugitive emissions. Air quality impacts from the construction and operation of Keystone's facilities are summarized in Section 4.2.1.

The climate data presented here are representative of the region where pipeline construction emissions could impact air quality. Historical climate data from meteorological stations along the proposed pipeline route for Circle, Montana; Midland, South Dakota; Lincoln, Nebraska; Marion Lake, Kansas; Cushing, Oklahoma; Nederland (Beaumont/Port Arthur), Texas; and Houston, Texas, are found in Table 3.2-1.

3.2.1 Regional Climate

3.2.1.1 Humid Continental Climate

The Steele City Segment and the pump stations located along the Keystone Cushing Extension are located within the humid continental climate that is found over great expanses in the temperate regions of the mid-latitudes. The humid continental climate is noted for its variable weather patterns and its large temperature range due to its interior location in mid-latitude continents. This climate lies in the boundary zone between many different air masses, principally polar and tropical. Polar-type air masses collide with tropical-type air masses causing uplift of the less dense and moister tropical air, resulting in precipitation. These huge systems generally work their way across the surface in a west to east fashion, embedded in the dominant wind flow of the westerly wind belt.

During the winter, the polar high expands in area to influence the northern portion of the continental humid climate. Record-setting cold temperatures occur during winter when continental arctic air masses sweep into the region. Otherwise, continental polar air masses dominate for much of the winter. Precipitation in the humid continental climate is primarily due to invasions of maritime tropical air. A noticeable decrease and seasonality to the precipitation occurs as distance from the Gulf of Mexico increases. Examples of temperature and precipitation variability can be identified in Table 3.2-1.

Cool Summer Subtype

The cool summer subtype of the humid continental climate in North America is found throughout much of the Great Lakes region and upper Midwest extending into south central Canada. Most of its precipitation falls in the summer half of the year. However, it receives less precipitation than the warm summer subtype due to the colder temperatures and their associated lower humidity.

Warm Summer Subtype

The warm summer subtype is noted for its hot, humid summers and occasional winter cold waves. Lincoln, Nebraska; Marion Lake, Kansas; and Cushing, Oklahoma, lie in the warm summer subtype. Lincoln has an average annual temperature of 62.9°F, while Marion Lake and Cushing are slightly higher. These locales have rather large annual average temperature ranges. Summer high temperatures average over 89°F, while winter low temperatures average 12 to 20°F. Typical of the humid continental climate most of its precipitation falls during the summer when air masses are warmer and wetter.

3.2.1.2 Humid Subtropical Climate

The humid subtropical climate can be found in the southeastern United States and is noted for its warm summer months and relatively mild winters. The east coast location of the humid subtropical climate places it near the source region for maritime tropical air. Additionally, warm ocean currents paralleling these coasts further enhance the instability of the air. These factors combine to produce moderate amounts of precipitation in most months of the year. The humid subtropical climate is subject to cold temperatures during the winter as air masses embedded in cyclonic storms pass through this region. The high humidity experienced in the humid subtropical climate makes warm days feel oppressive. The daily temperature range tends to be very small as the evening does not cool down much during the summer. Beaumont, Texas, located at approximately 30° latitude, lies in the humid subtropical climate. Beaumont, Texas, has an average maximum annual temperature of 78.1°F and an average minimum annual temperature of 59.2°F. The Steele City tank farm and part of the Gulf Coast Segment and all of the Houston Lateral are in the humid subtropical climate.

3.2.2 Air Quality Regulatory Requirements

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- Greenhouse Gases (GHG);
- New Source Performance Standards (NSPS);
- National Emission Standards for Hazardous Air Pollutants (NESHAP; and
- Title V Operating Permits.

Table 3.2-1 Climate Data in the Vicinity of the Project

State	Monthly Average												
Circle, Montana Location[1]	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Average Max. Temperature (°F)	26.0	33.1	43.2	57.7	68.8	78.2	86.9	85.8	73.4	59.7	42.0	30.2	57.1
Average Min. Temperature (°F)	3.8	10.6	19.4	31.1	41.5	50.3	55.8	53.9	42.8	31.9	19.0	8.2	30.7
Average Total Precipitation (in.)	0.44	0.31	0.60	1.27	2.04	2.61	1.94	1.27	1.28	0.82	0.37	0.45	13.40
Average Total Snow Fall (in.)	5.6	3.4	3.6	2.2	0.4	0.0	0.0	0.0	0.1	0.9	2.6	5.1	23.9
Average Snow Depth (in.)	4	4	1	0	0	0	0	0	0	0	0	2	1
Midland, South Dakota Location[2]	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Average Max. Temperature (°F)	32.8	38.3	47.2	62.4	73.2	82.5	90.8	89.9	79.2	65.7	48.1	36.6	62.2
Average Min. Temperature (°F)	6.0	11.1	20.2	32.6	44.1	54.0	59.6	57.4	45.9	33.5	20.1	10.2	32.9
Average Total Precipitation (in.)	0.31	0.43	1.06	1.64	2.82	3.12	2.17	1.69	1.35	1.07	0.47	0.28	16.41
Average Total Snow Fall (in.)	3.9	5.8	6.4	1.8	0.2	0.0	0.0	0.0	0.0	0.6	3.1	4.4	26.2
Average Snow Depth (in.)	1	1	1	0	0	0	0	0	0	0	0	1	0
Lincoln, Nebraska Location[3]	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Average Max. Temperature (°F)	33.8	39.9	50.7	63.8	73.9	84.6	89.3	86.6	78.6	66.3	49.7	37.5	62.9
Average Min. Temperature (°F)	12.2	17.8	27.5	38.9	50.2	60.7	66.0	63.6	53.1	40.3	27.4	16.5	39.5
Average Total Precipitation (in.)	0.72	0.85	2.09	2.91	4.30	3.64	3.38	3.38	2.95	1.87	1.53	0.82	28.44
Average Total Snow Fall (in.)	6.4	5.3	5.1	1.4	0.0	0.0	0.0	0.0	0.0	0.6	2.6	5.4	26.7
Average Snow Depth (in.)	2	2	0	0	0	0	0	0	0	0	0	1	0
Marion Lake, Kansas Location[4]	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Average Max. Temperature (°F)	37.9	43.9	55.1	66.1	75.1	84.8	91.4	89.9	81.0	69.1	53.7	41.8	65.8
Average Min. Temperature (°F)	17.1	21.3	31.6	42.6	52.8	62.5	67.7	65.4	55.8	43.7	31.8	21.7	42.8
Average Total Precipitation (in.)	0.74	0.90	2.35	3.04	4.61	4.93	3.82	3.84	3.23	2.79	1.73	1.01	33.0
Average Total Snow Fall (in.)	1.1	1.1	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.0	4.0
Average Snow Depth (in.)	0	0	0	0	0	0	0	0	0	0	0	0	0
Keystone Cushing, Oklahoma Location[5]	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Average Max. Temperature (°F)	45.8	52.2	61.2	71.0	78.4	86.5	92.7	92.4	83.6	73.4	59.4	49.0	70.5
Average Min. Temperature (°F)	24.6	29.8	38.6	48.1	58.2	66.7	71.3	69.9	61.5	49.7	38.1	28.3	48.7

Table 3.2-1 Climate Data in the Vicinity of the Project

State	Monthly Average												
Average Total Precipitation (in.)	1.24	1.89	3.21	3.73	5.83	4.37	2.89	2.70	40.7	3.40	2.93	1.91	38.17
Average Total Snow Fall (in.)	3.0	1.7	0.9	T	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.2	7.1
Average Snow Depth (in.)	0	0	0	0	0	0	0	0	0	0	0	0	0
Beaumont/Port Arthur Texas Location[7]	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Average Max. Temperature (°F)	61.5	65.3	72.0	77.8	84.3	89.4	91.6	91.7	88.0	80.5	70.9	63.9	78.1
Average Min. Temperature (°F)	42.9	45.9	52.4	58.6	66.4	72.3	73.8	73.2	69.4	59.6	50.8	44.5	59.2
Average Total Precipitation (in.)	5.69	3.35	3.75	3.84	5.83	6.58	5.23	4.85	6.10	4.67	4.75	5.25	59.89
Houston, Texas Location[8]	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Average Max. Temperature (°F)	59.1	65.9	75.4	76.4	84.7	89.7	88.7	93.4	90.1	84.3	74.2	70.8	79.4
Average Min. Temperature (°F)	45.1	46.7	58.3	59.0	69.1	75.1	75.5	78.0	74.5	64.1	55.6	49.6	62.6
Average Total Precipitation (in.)	6.72	1.35	8.77	4.76	9.62	5.58	9.95	7.25	6.31	1.82	4.36	1.64	5.93

[1]Source: Western Regional Climate Center (WRCC), Circle, Montana, Station 241758, http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?mt1758

[2]Source: High Plaines Regional Climate Center (HPRCC), Midland, South Dakota, Station 395506, http://hprcc1.unl.edu/cgi-bin/cli_perl_lib/cliMAIN.pl?sd5506

[3]Source: High Plaines Regional Climate Center (HPRCC), Lincoln WSO Airport, Nebraska, Station 254795, http://hprcc1.unl.edu/cgi-bin/cli_perl_lib/cliMAIN.pl?ne4795

[4]Source: High Plaines Regional Climate Center (HPRCC), Marion Lake, Kansas, Station 145039, http://hprcc1.unl.edu/cgi-bin/cli_perl_lib/cliMAIN.pl?ks5039

[5]Source: National Oceanic and Atmospheric Association (NOAA), Cushing, Oklahoma, Station CUS02, http://www.srh.noaa.gov/oun/climate/getnorm.php?id=cuso2

[6] Statistics for average snow depths are not available; however, average snow depths for this latitude are negligible.

[7]Source: National Oceanic and Atmospheric Association (NOAA), Beaumont, Texas, http://www.srh.noaa.gov/lch/climate/coop/KBPT.htm

[8]Source: National Oceanic and Atmospheric Association (NOAA), Houston, Texas, http://www.srh.noaa.gov/hgx/climate/reviews/010308pns.txt

T=Trace amounts

The Project will also be subject to air quality regulatory programs in Nebraska (discussed in Section 3.2.2.7).

3.2.2.1 National Ambient Air Quality Standards

The United States Environmental Protection Agency (US EPA) promulgated air quality standards for six common air pollutants (also called criteria pollutants):

- ozone (O_3);
- nitrogen dioxide (NO_2);
- carbon monoxide (CO);
- sulfur dioxide (SO_2);
- lead (Pb); and
- particulate matter based on a particle size of 10 microns or less (PM_{10}), and particulate matter with an aerodynamic diameter less than or equal to 2.5 microns ($PM_{2.5}$).

These standards include primary standards designed to protect health, and secondary standards to protect public welfare, predominately visibility. These NAAQS reflect the relationship between pollutant concentrations and health and welfare effects and are supported by sound scientific evidence.

Each state is required to implement and enforce the NAAQS under a process called State Implementation Plans (SIPs), which are approved by the US EPA. Generally the SIPs are comprised of air quality rules that are applicable to stationary sources that may emit criteria or hazardous air pollutants. The CAA as amended in 1990 assigned new NAAQS attainment deadlines of 3 to 20 years and categorized nonattainment as marginal, moderate, serious, severe, or extreme, depending upon the degree of violation of the NAAQS. The 1-hour and 8-hour CO standard, 3-hour and 24-hour SO_2 standard, and 24-hour PM_{10} standard shall not be exceeded more than once per year. The NAAQS that are based on annual pollutant averaging periods are not to be exceeded.

The National and Nebraska Ambient Air Quality Standards (NAAQS and NEAAQS) and PSD Increments for Class I and Class II Areas are listed in Table 3.2-2. In order to compare the standards, all levels that were stated in parts per million (ppm) or parts per billion (ppb) were converted to micrograms per cubic meter (μg/m^3).

Table 3.2-2 Ambient Air Quality Standards

Pollutant	Averaging Period	NAAQS (μg/m^3)	NEAAQS (μg/m^3)	PSD Class I Increment (μg/m^3)	PSD Class II Increment (μg/m^3)
NO_2	Annual	100	100	2.5	25
CO	1-Hour 8-Hour	40,000 10,000	40,000 10,000	N/A N/A	N/A N/A
SO_2	3-Hour 24-Hour Annual	1300 365 80	1300 365 80	25 5 2	512 91 20
PM_{10}	24-Hour Annual	150 50(1)	150 50	8 4	30 17
$PM_{2.5}$	24-Hour(2) Annual(3)	35 15	35 15	N/A N/A	N/A N/A

Table 3.2-2 Ambient Air Quality Standards

Pollutant	Averaging Period	NAAQS ($\mu g/m^3$)	NEAAQS ($\mu g/m^3$)	PSD Class I Increment ($\mu g/m^3$)	PSD Class II Increment ($\mu g/m^3$)
O_3	8-Hour[(4)]	147	147	N/A	N/A
Pb	Quarterly	1.5	1.5	N/A	N/A
	3-month rolling	0.15	--	N/A	N/A

[1] The PM_{10} annual standard has been revoked; however, state regulations may still include the annual PM_{10} standard.
[2] Based on the 3-year average of the 98th percentile within an area.
[3] Based on the 3-year average of weighted annual mean.
[4] The fourth highest 8-hour concentration in each year, averaged over three consecutive years, must not exceed 0.075 parts per million (ppm).
Source: US EPA 2008, http://www.epa.gov/air/criteria.html.

3.2.2.2 Prevention of Significant Deterioration

PSD regulations are designed to prevent significant deterioration of air quality in areas that are classified as attainment or unclassified. PSD review regulations apply to proposed new or modified sources in those areas that have the potential to emit criteria pollutants in excess of predetermined *de minimis* values (40 CFR Section 52.21). Increments for criteria pollutants are based on the PSD classification of the area. Class I areas are assigned to federally protected wilderness areas, such as national parks, and allow the lowest increment of permissible deterioration. This essentially precludes development near these areas. Class II areas are designed to allow for moderate, controlled growth, and Class III areas allow for heavy industrial use.

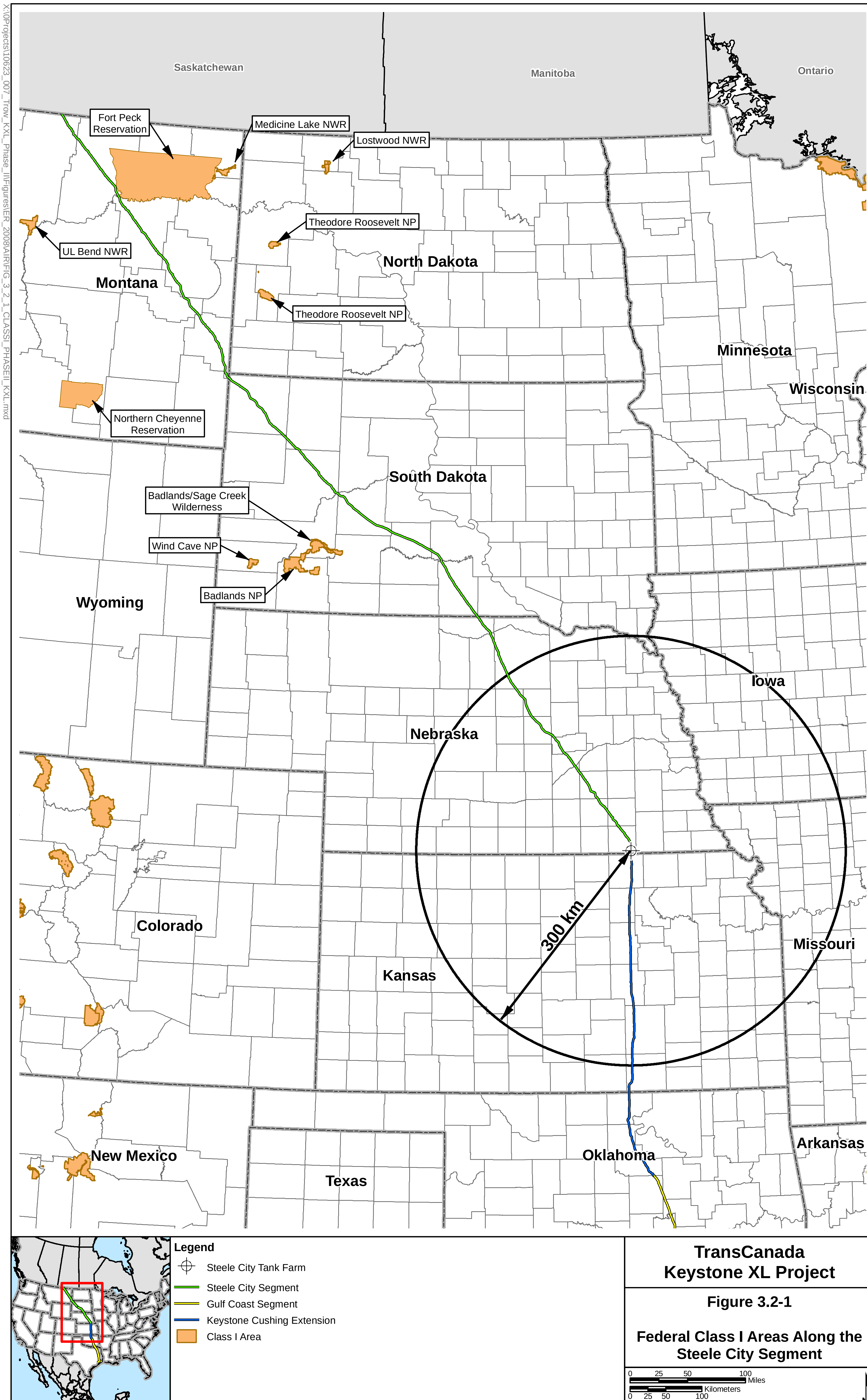
Under the PSD program, a major source is defined in 40 CFR Part 52, “A source is a ‘major stationary source’ or ‘major emitting facility’ if:

1. It can be classified in one of the 28 named source categories listed in Section 169 of the CAA and it emits or has the potential to emit 100 tons per year (tpy) or more of any pollutant regulated by the Act; or

2. It is any other stationary source that emits or has the potential to emit 250 tpy or more of any pollutants regulated by the CAA.” (US EPA 1990)

The category of “petroleum storage and transfer units with a total storage capacity exceeding 300,000 barrels” is one of the 28 named source types; therefore, facilities that meet this definition that are located in attainment or unclassified areas are subject to the 100 tpy threshold for major source PSD permitting. The proposed Steele City tank farm meets this definition.

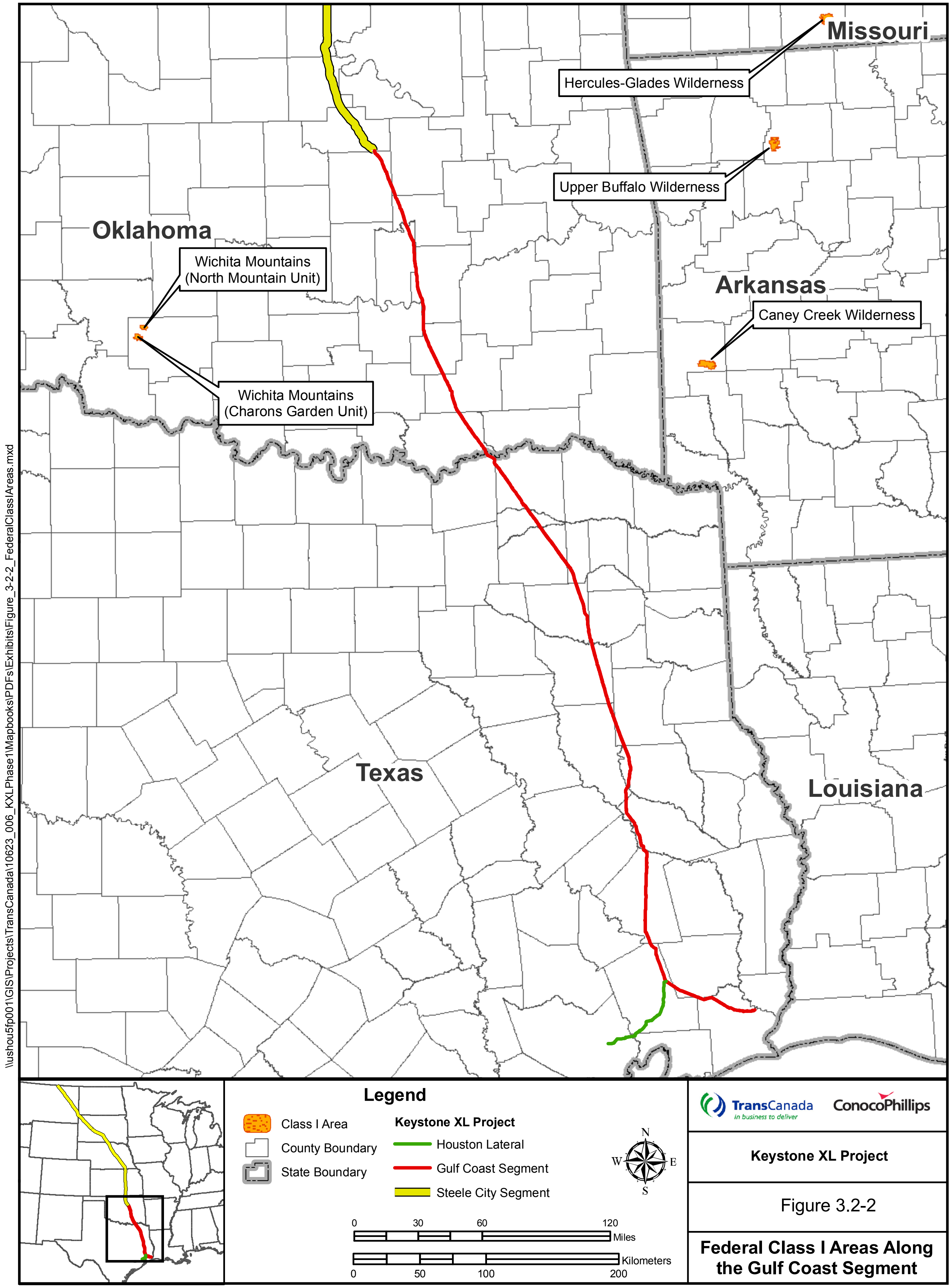
The proposed pipeline ROW does not intersect a designated Federal Class I area; therefore, the Project is designated as a PSD Class II area under state and federal air quality regulations. Figure 3.2-1 and Figure 3.2.2 identifies the Federal Class I areas along the Project. The proposed Steele City tank farm is not located within 300 kilometers of a Federal Class I area.



TransCanada
Keystone XL Project

Figure 3.2-1

Federal Class I Areas Along the Steele City Segment



Keystone XL Project

Figure 3.2-2

Federal Class I Areas Along the Gulf Coast Segment

3.2.2.3 New Source Review

New Source Review (NSR) permitting is required for all major new sources of potential emitters in both nonattainment and attainment areas. NSR permits are usually issued by state or local air pollution control agencies; therefore, NSR permitting will apply to the Steele City tank farm.

The following lists the basic elements of a NSR permit:

- legal authority – specification of the legal authority to issue the permit;
- technical specifications;
- emission compliance determination;
- definition of excess emissions;
- administrative procedures; and
- other specific conditions.

3.2.2.4 Greenhouse Gases

Carbon dioxide ($CO_{2)}$, methane ($CH_{4)}$, and NO_2 are all naturally occurring greenhouse gases (GHGs) whose concentrations in the atmosphere have increased as a result of human activities since the dawn of the industrial revolution. GHGs in general and CO_2 in particular, have become an issue of intense public debate and much recent litigation. In Massachusetts vs. the US EPA, the US Supreme Court held that CO_2 satisfies the definition of "air pollutant" and that the EPA has authority to regulate emissions of CO_2 and other GHGs from new motor vehicles under the CAA (Massachusetts vs. the US EPA, 2007). It is important to note that the Court did not rule that CO_2 and other GHGs were subject to regulation under the CAA, nor did the Court require creation of any standards or emission control requirements for GHGs.

CO_2, CH_4, and NO_2 are not criteria pollutants for which NAAQS are set, nor are they regulated under NSPS, MACT, or any other CAA regulatory emission standard or limitation. Therefore, although CO_2 was defined as being an air pollutant, it is not a regulated air pollutant for CAA regulatory and permitting purposes. No regulatory limitations or other CAA emission standards apply to CO_2, CH_4 or NO_2.

3.2.2.5 New Source Performance Standards (NSPS)

The regulation of new sources, through the development of standards applicable to a specific category of sources, was a significant step taken by the CAA. These regulations establish a standard of performance for new, modified, or reconstructed sources, which fall into any specified source category, regardless of geographic location or the existing ambient air quality. The standards defined emission limitations for a particular source group. The NSPS potentially applicable to the Project will include:

- Subpart A – General Provisions; and
- Subpart Kb – Standards of Performance for Volatile Organic Storage Vessels.

<u>Subpart A – General Provisions</u>

Certain provisions of 40 CFR Part 60 Subpart A apply to the owner or operator of any stationary source subject to a NSPS. Applicable Subpart A provisions are identified in Table 3.2-3.

Table 3.2-3 Summary of Regulatory Requirements of NSPS Subpart A – General Provisions

40 CFR Part 60 Subpart A Section	Requirement	Compliance Action
60.7	Notification and recordkeeping	Keystone will submit all NSPS-related notifications to US EPA Region VII and NDEQ for the proposed Project in a timely manner.
60.8	Performance tests	Keystone will conduct all required performance tests using designated reference test methods or other methods approved by the Administrator.
60.11	Compliance with standards and maintenance requirements	Keystone will operate and maintain the units using good air pollution control practices
60.13	Monitoring requirements	Required pollutant monitoring pursuant to NSPS will utilize methods outlined in 60.13.
60.19	General notification and reporting requirements	All NSPS reports and notification will follow the format and schedule set forth in 60.19.

Subpart Kb – Volatile Organic Liquid Storage Vessels

Subpart Kb applies to storage vessels containing volatile organic liquids (VOLs) with a capacity greater than 75 m^3 (approximately 19,800 gallons). The regulation identifies specific technology options for these facilities.

As stated in 40 CFR Part 60.112b(a), the owner or operator of a storage vessel with a design capacity ≥151m^3 (approximately 39,900 gallons) containing a VOL that has a maximum true vapor pressure ≥5.2 kPa (approximately 0.7 psia) shall equip each storage vessel with one of several control options. One of these options, as provided in 40 CFR Part 60.112b(a)(1), is for each tank to be equipped with a fixed roof in combination with an internal floating roof (IFR). Each of the crude oil tanks to be located at the Steele City tank farm will be installed with a fixed roof in combination with an IFR.

As stated in 40 CFR Part 60.112b(a)(1)(ii), each IFR shall be equipped with one of the following closure devices between the wall of the storage vessel and the edge of the IFR: a mechanical shoe seal; a foam- or liquid-filled seal mounted in contact with the liquid; or two seals mounted one above the other so that each forms a continuous closure. Each of the IFRs in the crude oil tanks to be located at the Steele City tank farm will be installed with a mechanical shoe seal; therefore, the applicable regulatory requirement will be met. The Project will comply with all other applicable provisions of Subpart Kb.

3.2.2.6 Title V – Major Source Operation Permit

The CAA Amendments of 1990, under revisions to Section 112, required the US EPA to list and promulgate national emission standards for hazardous air pollutants from categories of major and area sources. Under the National Emissions Standards for Hazardous Air Pollutants, the US EPA regulates emissions of toxic air pollutants, listed as hazardous air pollutants (HAPs), from a published list of industrial sources referred to as "source categories."

Under Title V of the CAA, in addition to any required pre-construction permits, all "major" stationary sources emitting certain air pollutants are required to obtain operating permits. A major stationary source under Title V regulations is defined as a source that has emissions of one or more criteria pollutants above 100 tpy, or if HAP emissions from a facility are above 10 tpy (individually) or 25 tpy (collectively). Under 40 CFR Part 70, the US EPA promulgated the minimum requirements for Title V operating permits. Most Title V permits are

issued by state and local permitting authorities. These permits are legally enforceable documents designed to improve compliance by clarifying what operating facilities (sources) must do to control air pollution.

3.2.2.7 Applicable State Requirements

Nebraska

The State of Nebraska has authority to implement the major source operating permit program (Title V). The operating permit regulations are contained in Nebraska Administrative Code Title 129, Chapters 7 through 14.

The Nebraska Administrative Code (NAC), Title 129, lays the framework for the state air quality laws and regulations. The NAC establishes the legal authority of the Nebraska Department of Environmental Quality (NDEQ) to enforce the regulations set forth by the Nebraska Environmental Protection Act and the Environmental Quality Council. Table 3-2-4 lists the Nebraska air quality regulations and determines Project applicability.

The NDEQ does not generally require modeling for ozone impacts for minor sources. For PSD major sources, the regulation (40 CFR Part 52.21(i)(5)(i)) requires an evaluation of ozone levels and impacts if the total emission rate of volatile organic compounds (VOCs) is 100 tpy or more. Since VOC emissions are projected to be less than 100 tpy, impacts on ozone from this Project can be considered insignificant.

Table 3.2-4 Air Quality Regulations Applicability Table

Regulation Title	Applicability	Reason
Chapter 1 – Definitions	Applicable	Applies to all new and existing sources
Chapter 2 – Definition of Major Source	Not Applicable	Facility will not be a major source and will not be located in a nonattainment area
Chapter 3 – Regions and Subregions: How Classified	Applicable	Facility will be located in the Lincoln-Beatrice-Fairbury Intrastate AQCR 145
Chapter 4 – Ambient Air Quality Standards	Applicable	Facility will be in compliance with AAQSs
Chapter 5 – Operating Permits - When Required	Not Applicable	Facility will not be a major source of criteria pollutants or HAPs
Chapter 6 – Emissions Reporting: When Required	Applicable	Facility will submit annual emission inventory reports when required
Chapter 7 – Operating Permits - Application	Applicable	Facility will file a Class II operating permit application within the designated timeframe
Chapter 8 – Operating Permit Content	Applicable	Facility will include all appropriate information when filing the Class II operating permit application
Chapter 9 – General Operating Permits for Class I and Class II Sources	Applicable	Facility will include all appropriate information when filing the Class II operating permit application
Chapter 10 – Operating Permits for Temporary Sources	Not Applicable	Facility is not a temporary source
Chapter 11 – Operating Permits - Emergency; Defense	Applicable	Facility will keep appropriate documentation if and when an emergency occurs
Chapter 12 – Operating Permit Renewal and Expiration	Applicable	Facility will submit a renewal application within the appropriate timeframe
Chapter 13 – Class I Operating Permit - EPA Review; Affected States Review; Class II Permit	Applicable	Facility will not be a Class I source; Class II provisions apply
Chapter 14 – Permits - Public Participation	Applicable	Facility will comply with applicable provisions
Chapter 15 – Operating Permit Modifications; Reopening for Cause	Applicable	Facility will comply with applicable provisions

Table 3.2-4 Air Quality Regulations Applicability Table

Regulation Title	Applicability	Reason
Chapter 16 – Stack Heights; Good Engineering Practice (GEP)	Applicable	Facility will construct stacks in compliance with GEP
Chapter 17 – Construction Permits	Applicable	Facility is submitting construction permit application
Chapter 18 – New Source Performance Standards	Applicable	Facility will comply with applicable NSPSs
Chapter 19 – Prevention of Significant Deterioration of Air Quality	Not Applicable	Facility will not be a PSD source
Chapter 20 – Particulate Emissions; Limitations and Standards	Applicable	Facility will be in compliance with particulate emission standards
Chapter 21 – Controls for Transferring, Conveying, Railcar and Truck Loading at Rock Processing Operations in Cass County	Not Applicable	Facility not located in Cass County
Chapter 22 – Incinerators; Emission Standards	Not Applicable	Facility is not an incinerator
Chapter 23 – Hazardous Air Pollutants: Emission Standards	Not Applicable	Facility not included in Part 61 category
Chapter 24 – Sulfur Compound Emissions: Existing Sources Emission Standards	Not Applicable	Facility is not an existing source
Chapter 25 – Nitrogen Oxides (Calculated as Nitrogen Dioxide); Emissions Standards for Existing Stationary Sources	Not Applicable	Facility is not a nitric acid plant
Chapter 26 – Acid Rain	Not Applicable	Facility not subject to the Acid Rain Program
Chapter 27 – Hazardous Air Pollutants; Maximum Achievable Control Technology (MACT)	Not Applicable	Facility will not be a major source of HAPs, and HAP emission rates below state MACT thresholds
Chapter 28 – Hazardous Air Pollutants; Emissions Standards	Not Applicable	Facility will not be a major source of HAPs
Chapter 29 – Operating Permit Emission Fees	Not Applicable	Facility will not be a Class I source
Chapter 30 – Open Fires, Prohibited; Exceptions	Potentially Applicable	Open burning or prescribed fire will not be conducted without proper approvals
Chapter 31 – Compliance Assurance Monitoring	Not Applicable	Facility not subject to CAM
Chapter 32 – Dust; Duty to Prevent Escape of	Applicable	Facility will comply with applicable provisions
Chapter 33 – Compliance; Time Schedule For	Applicable	Facility will be in compliance with applicable regulations by the required timeframe
Chapter 34 – Emission Sources; Testing; Monitoring	Applicable	Facility will conduct required testing and monitoring within the designated timeframes
Chapter 35 – Compliance; Exceptions Due to Startup, Shutdown, or Malfunction	Applicable	Facility will comply with provisions during excess emission events
Chapter 36 – Control Regulations; Circumvention, When Excepted	Applicable	Facility will not circumvent regulations
Chapter 37 – Compliance; Responsibility of Owner/Operator Pending Review by Director	Applicable	Facility will comply with applicable provisions

Table 3.2-4 Air Quality Regulations Applicability Table

Regulation Title	Applicability	Reason
Chapter 38 – Emergency Episodes; Occurrence and Control, Contingency Plans	Applicable	Facility will comply with applicable provisions if an emergency episode occurs
Chapter 39 – Visible Emissions From Diesel-Powered Motor Vehicles	Not Applicable	Facility not included in source category
Chapter 40 – General Conformity	Not Applicable	Facility is not a part of transportation plan requirements
Chapter 41 – General Provisions	Applicable	Facility will comply with applicable provisions
Chapter 42 – Permits-by-Rule	Not Applicable	Facility not in appropriate source category

3.2.3 Air Quality Regulation Applicability to Project Facilities

Potential sources of emissions along the proposed pipeline route can be classified as one of three types: stationary, mobile, or fugitive. Because the proposed pump stations on the Project are to be electrically driven, the pump stations will not be potential sources of stationary emissions.

Mobile sources of emissions are the construction equipment to be used during construction of the pipeline, pump stations, and other ancillary facilities. Fugitive sources of emissions include particulate emissions from paved and unpaved roadways, particulate emissions from soil disturbance during construction activities, fugitive tailpipe emissions from the operation of earthmoving equipment and commuter vehicles, and leaks or programmed releases of volatile constituents in fuels and crude oil from pipeline components such as valves, pumps, flanges, and connections. Typically, only negligible amounts of fugitive emissions occur from crude oil pipeline connections and are unquantifiable for the purpose of this Environmental Report at this time.

3.2.3.1 Steele City Segment

On the Steele City Segment of the Project, the Steele City tank farm is the only facility potentially subject to the air quality regulations discussed in Section 3.2.2.

All counties along the Steele City Segment are designated as being in attainment with the NAAQS. Areas along this segment of the proposed pipeline corridor are designated as PSD Class II under state and federal air quality regulations. If potential emissions from the proposed Steele City tank farm exceed the applicable PSD threshold, the tank farm could be a major source subject to PSD review.

The proposed Steele City tank farm is estimated to have VOC emissions below the 100 tpy threshold that is required for PSD permitting and below the 100 tpy threshold that requires evaluation of ozone impacts under PSD (40 CFR Part 52.21(i)(5)(i)). As shown in Section 4.2.-1, potential emissions from the proposed Project are below 100 tpy for all regulated pollutants; therefore, PSD review does not apply.

Subpart Kb of the NSPS applies to storage vessels containing volatile organic liquids (VOLs) with a capacity greater than 75 m^3 (approximately 19,800 gallons). The three crude oil storage tanks will each have storage capacities greater than 75 m^3 since preliminary design of each storage tank includes storage of 350,000 barrels (bbls) (14,700,000 gallons) of crude oil. The specifications of the crude oil to be stored at the Steele City tank farm also reflect a maximum true vapor pressure greater than 5.2 kPa (approximately 0.75 psia). Since the crude oil storage tanks to be located at the Steele City tank farm will be subject to NSPS, Subpart Kb, the proposed tank farm will also be required to comply with the applicable provisions of NSPS, Subpart A.

The Steele City tank farm is not a major Hazorous Air Pollution (HAP) source because emissions of chemicals such as benzene, toluene, ethylbenzene, xylene, and hexane are below the 10/25 tpy major source threshold levels. Therefore MACT requirements will not apply.

The proposed crude oil storage tanks to be located at the Steele City tank farm will have criteria pollutant emission levels below 100 tpy. Therefore, the Steele City tank farm will not be subject to Title V operating permit requirements. If the Steele City tank farm becomes a major source at some point in the future, a Title V operating permit application will be submitted to the NDEQ so that it can be deemed complete no later than 12 months after the facility becomes major.

The Steele City tank farm will be subject to Nebraska air quality regulations.

3.2.3.2 Pump Stations along the Keystone Cushing Extension

On the Keystone Cushing Extension, two new pump stations potentially are subject to the air quality regulations discussed in Section 3.2.2. However, as all of the pumps and associated equipment to be installed are to be electrically driven, the pump stations will not emit regulated air pollutants in quantities that would trigger permitting requirements.

All counties where these Keystone Cushing Extension pump stations are located are designated as being in attainment with the NAAQS. These areas are designated as PSD Class II under state and federal air quality regulations.

3.2.3.3 Gulf Coast Segment

On the Gulf Coast Segment of the Project, there are no facilities subject to air quality regulations

Along the Gulf Coast Segment, all counties except Hardin and Jefferson Counties in Texas are designated as being in attainment with the NAAQS. The Project is in compliance with the NAAQS in these non-attainment counties. In attainment areas of this segment, no facilities will exceed PSD thresholds.

3.2.3.4 Houston Lateral

On the Houston Lateral, there are no facilities subject to air quality regulations discussed in Section 3.2.2.

Along the Houston Lateral, all counties except Liberty and Harris Counties in Texas are designated as being in attainment with the NAAQS. The Project is in compliance with the NAAQS in these non-attainment counties.

3.3 Geology, Mineral Resources, and Paleontology

This section discusses the geology, mineral resources, paleontology, and geologic hazards along the Project route.

3.3.1 Montana–Steele City Segment

3.3.1.2 Geology

The proposed Project is located in the Great Plains physiographic province (Fenneman 1928). In eastern Montana, the Great Plains is divided into two major sections: the Glaciated Missouri Plateau and the Unglaciated Missouri Plateau (Figure 3.3-1). The Missouri Plateau is essentially a dissected plateau characterized by badlands, buttes, mesas, and exhumed mountain ranges like the Black Hills. The proposed route is in the Glaciated Missouri Plateau from the US-Canada border to near Circle, Montana. The glaciated area is generally of low relief compared with the unglaciated area, which has a greater variety of landforms (Trimble 1980). The Glaciated Missouri Plateau is covered by glacial deposits, but the boundary between the glaciated and unglaciated sections is not distinct because the glacial deposits thin gradually. The route crosses the Unglaciated Missouri Plateau south from the vicinity of Circle, Montana, to the South Dakota state

line. Elevations along the proposed route vary from 3,000 feet above mean sea level (amsl) in the northern and southeastern parts of the Project area to around 2,000 feet amsl at the Missouri River.

The surficial deposits primarily are composed of Quaternary alluvium and colluvium and glacial till. The alluvium primarily occurs in modern channels and floodplains, but also is present in older river terraces or in glacial deposits.

The bedrock geology consists of Upper Cretaceous and Tertiary rocks. Table 3.3-1 provides a description of the bedrock rock units crossed by the proposed route. The Claggett Shale and the Bearpaw Shale were deposited under marine conditions and the Judith River Formation was deposited under marine to marginal marine conditions (Condon 2000). The Fox Hills Formation is a marginal marine sandstone that has widespread distribution throughout the Northern Rocky Mountain basins from northeast Colorado to Montana. Overlying the Fox Hills Formation is the Hell Creek Formation, which was deposited under non-marine conditions in depositional environments of river channels, floodplains, and lakes.

The Tertiary section is primarily represented by various members of the Fort Union Formation, which was deposited under non-marine conditions similar to the Hell Creek Formation in river channels, floodplains, and lakes. Both the Hell Creek and Fort Union Formations appear to have been sourced by uplift and erosion of the emerging Rocky Mountains to the west and south of the Project area (McDonald 1971). The Flaxman Formation is thought to be Miocene in age and was deposited by braided streams sourced to the west and southwest (Leckie 2006).

The entire route crosses the western fringe of the Williston Basin, a major structural basin that covers northeast Montana, most of North Dakota, and northwest South Dakota (Figure 3.3-2) (Peterson and MacCary 1987). The Williston Basin also extends north into Saskatchewan and Manitoba in southern Canada. The basin contains approximately 15,000 feet of Paleozoic through Tertiary sedimentary rock. The center of the basin is located in western North Dakota and, in the Project area, the rocks dip gently towards the east and northeast. Major structural features crossed by the proposed route include the Hinsdale, Weldon-Brockton, and Poplar Fault Zones or Lineaments and the Cedar Creek Anticline. The fault zones or lineaments, extend into the Precambrian basement (ancient rocks that lie beneath the sedimentary rock section). These fault zones are thought to have influenced sedimentation patterns in the basin, but are not thought to be active at present (Fischer 2005). The Cedar Creek Anticline is a northwest to southeast trending anticlinal structure in southeastern Montana that extends into the southwestern corner of North Dakota and the northwestern corner of South Dakota (Clement 1987). The structure is 145 miles long and 6 to 20 miles wide. The Project is located on the southwest flank of the structure and generally parallels the strike of the anticline. Paleontological Reports for the Steele City Segment is only required on federal lands; therefore paleontological reports will only be provided for Montana.

3.3.1.3 Mineral Resources

The major energy mineral resources in the Project area are oil, natural gas, and coal (Montana Bureau of Mines and Geology 1963). Uranium deposits are also present, but do not represent an important resource. The major non-fuel mineral resources are sand, gravel, and bentonite (Montana Bureau of Mines and Geology/USGS 2004; Kennedy 1990). The Williston Basin is a major oil and gas producing basin. In the US portion of the basin, total production to the end of 2007 was approximately 2.5 billion barrels of oil and 470 billion cubic feet of gas (Burke 2006; Montana Board of Oil and Gas 2007; North Dakota Industrial Commission. 2007; South Dakota Oil and Gas Section 2008). Recent technological advances in oil production and recovery reversed oil production declines experienced in the 1990s. The recently tapped Bakken Formation has an estimated mean technically recoverable resource of 3.7 billion barrels of oil and 1.9 trillion cubic feet of gas (USGS 2008a). The pipeline route crosses a relatively low number of oil and gas producing areas since the route lies on the western edge of the basin. Appendix I lists wells that are within 1,320 feet of the proposed ROW.

The pipeline route crosses the Fort Union Coal region from just south of the Missouri River to the South Dakota state line (Averitt 1963). The coal in the Fort Union Formation is generally lignite in the Project area. To the southwest of the proposed route in the Powder River Basin, the coal becomes progressively higher rank to sub-bituminous and is mined extensively in that area of Montana as well as northeast Wyoming. No lignite mines are present along the proposed route.

In southeastern Montana, uranium-bearing lignites have been found in the Fort Union Formation (Weissenborn and Weiss 1963). While some fairly high-grade deposits have been identified in northeast Fallon County and northern Carter County, the proposed route does not intersect identified deposits. Lignite is not currently mined for uranium.

Bentonite, a clay derived from layers of volcanic ash, is present in mineable quantities in the Bearpaw Shale, but also occurs in other upper Cretaceous and Tertiary formations. Bentonite has variety of uses but is commonly used as a major constituent of drilling fluids and as a moisture absorbent. In the Project area, bentonite was mined in an area known as the Chinook-Malta-Glasgow bentonite district (Kennedy 1990). There are a number of abandoned pits in the Glasgow-Malta area. Bentonite was mined and processed southeast of Glasgow beginning in 1976 (BLM 1992). The processing plant was shut down in 1979, but mining continued until 1985. According to the BLM, the bentonite claims have been abandoned. As of 2004, there was no bentonite mining in the area (Montana Bureau of Mines and Geology/USGS 2004).

Aggregate production occurs from local deposits in floodplains and glacial deposits. Sand and gravel deposits have been identified to the east of the proposed route in glacial sediments in the Fort Peck Indian Reservation and areas to the north (Weis 1963). Gravel deposits also are present along the Yellowstone River where the route crosses the river. The proposed route does not cross aggregate mining operations.

3.3.1.4 Paleontological Resources

Last year the BLM adopted the Potential Fossil Yield Classification (PFYC) system to identify and classify fossil resources on federal lands (BLM 2007). The PFYC system is summarized briefly as follows (BLM 2007):

> "Occurrences of paleontological resources are closely tied to the geologic units (i.e., formations, members, or beds) that contain them. The probability for finding paleontological resources can be broadly predicted from the geologic units present at or near the surface. Therefore, geologic mapping can be used for assessing the potential for the occurrence of paleontological resources.
>
> Using the Potential Fossil Yield Classification (PFYC) system, geologic units are classified based on the relative abundance of vertebrate fossils or scientifically significant invertebrate or plant fossils and their sensitivity to adverse impacts, with a higher class number indicating a higher potential. This classification is applied to the geologic formation, member, or other distinguishable unit, preferably at the most detailed mappable level. It is not intended to be applied to specific paleontological localities or small areas within units. Although significant localities may occasionally occur in a geologic unit, a few widely scattered important fossils or localities do not necessarily indicate a higher class; instead, the relative abundance of significant localities is intended to be the major determinant for the class assignment.
>
> The PFYC system is meant to provide baseline guidance for predicting, assessing, and mitigating paleontological resources. The classification should be considered at an intermediate point in the analysis, and should be used to assist in determining the need for further mitigation assessment or actions."

The BLM intends for the PFYC System to be used as a guideline as opposed to rigorous definitions. Descriptions of the potential fossil yield classes are presented below (BLM 2007):

"Class 1 – Very Low. Geologic units that are not likely to contain recognizable fossil remains.

- Units that are igneous or metamorphic, excluding reworked volcanic ash units.
- Units that are Precambrian in age or older.

Class 2 – Low. Sedimentary geologic units that are not likely to contain vertebrate fossils or scientifically significant nonvertebrate fossils.

- Vertebrate or significant invertebrate or plant fossils not present or very rare.
- Units that are generally younger than 10,000 years before present.
- Recent aeolian deposits.
- Sediments that exhibit significant physical and chemical changes (i.e., diagenetic alteration).

Class 3 – Moderate or Unknown. Fossiliferous sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence; or sedimentary units of unknown fossil potential.

- Often marine in origin with sporadic known occurrences of vertebrate fossils.
- Vertebrate fossils and scientifically significant invertebrate or plant fossils known to occur intermittently; predictability known to be low.
- Poorly studied and/or poorly documented. Potential yield cannot be assigned without ground reconnaissance.

Class 3a – Moderate Potential. Units are known to contain vertebrate fossils or scientifically significant nonvertebrate fossils, but these occurrences are widely scattered. Common invertebrate or plant fossils may be found in the area and opportunities may exist for hobby collecting. The potential for a project to be sited on or impact a significant fossil locality is low, but is somewhat higher for common fossils.

Class 3b – Unknown Potential. Units exhibit geologic features and preservational conditions that suggest significant fossils could be present, but little information about the paleontological resources of the unit or the area is known. This may indicate the unit or area is poorly studied, and field surveys may uncover significant finds. The units in this Class may eventually be placed in another Class when sufficient survey and research is performed. The unknown potential of the units in this Class should be carefully considered when developing any mitigation or management actions.

Class 4 – High. These are geologic units containing a high occurrence of significant fossils. Vertebrate fossils or scientifically significant invertebrate or plant fossils are known to occur and have been documented, but may vary in occurrence and predictability. Surface disturbing activities may adversely affect paleontological resources in many cases.

Class 4a – Unit is exposed with little or no soil or vegetative cover. Outcrop areas are extensive with exposed bedrock areas often larger than two acres. Paleontological resources may be susceptible to adverse impacts from surface disturbing actions. Illegal collecting activities may impact some areas.

Class 4b – These are areas underlain by geologic units with high potential but have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation due to moderating circumstances. The bedrock unit has high potential, but a protective layer of soil, thin alluvial material, or other conditions may lessen or prevent potential impacts to the bedrock resulting from the activity.

- Extensive soil or vegetative cover; bedrock exposures are limited or not expected to be impacted.
- Areas of exposed outcrop are smaller than two contiguous acres.
- Outcrops form cliffs of sufficient height and slope so that impacts are minimized by topographic conditions.

- Other characteristics are present that lower the vulnerability of both known and unidentified paleontological resources.

Class 4 and Class 5 units may be combined as Class 5 for broad applications, such as planning efforts or preliminary assessments, when geologic mapping at an appropriate scale is not available. Resource assessment, mitigation, and other management considerations are similar at this level of analysis, and impacts and alternatives can be addressed at a level appropriate to the application.

The probability for impacting significant paleontological resources is moderate to high and is dependent on the proposed action. Mitigation considerations must include assessment of the disturbance, such as removal or penetration of protective surface alluvium or soils, potential for future accelerated erosion, or increased ease of access resulting in greater looting potential. If impacts to significant fossils can be anticipated, on-the-ground surveys prior to authorizing the surface disturbing action will usually be necessary. On-site monitoring or spot-checking may be necessary during construction activities.

Class 5 – Very High. Highly fossiliferous geologic units that consistently and predictably produce vertebrate fossils or scientifically significant invertebrate or plant fossils and that are at risk of human-caused adverse impacts or natural degradation.

Class 5a – Unit is exposed with little or no soil or vegetative cover. Outcrop areas are extensive with exposed bedrock areas often larger than two contiguous acres. Paleontological resources are highly susceptible to adverse impacts from surface disturbing actions. Unit is frequently the focus of illegal collecting activities.

Class 5b – These are areas underlain by geologic units with very high potential but have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation due to moderating circumstances. The bedrock unit has very high potential, but a protective layer of soil, thin alluvial material, or other conditions may lessen or prevent potential impacts to the bedrock resulting from the activity.

- Extensive soil or vegetative cover; bedrock exposures are limited or not expected to be impacted.
- Areas of exposed outcrop are smaller than two contiguous acres.
- Outcrops form cliffs of sufficient height and slope so that impacts are minimized by topographic conditions.
- Other characteristics are present that lower the vulnerability of both known and unidentified paleontological resources."

Table 3.3-1 summarizes the paleontologic resource potential and sensitivity of geologic formations crossed by the proposed route. The proposed route was surveyed for paleontologic resources (See Appendix G). Several of the formations--Judith River, Hell Creek, and Fort Union--have a high degree of sensitivity for paleontologic resources because of the high potential for the presence of scientifically important fossils. During the 2008 field surveys, 20 non-significant fossil occurrences were documented and 14 significant fossil localities were discovered. Paleontological reports for the Steele City Segment are only required on federal lands, therefore paleontogical reports to BLM for Montana.

Table 3.3-1 **Summary of Geological and Paleontologic Resources Along the Proposed Route in Montana**

Geologic Formation (Fm)/Deposit (Map Symbol)	Period	Description	BLM Potential Fossil Yield Classification System (PFYC) Class/Types of Fossils	Milepost
Alluvium/colluvium (Qal), landslides (Qls), sand and gravel (Tsg)	Tertiary – Quaternary	Sand, gravel and clay	Class 2/Mammals.	Occur sporadically throughout route, alluvium primarily occurs along drainages and river crossings.
Flaxville Fm. (Tf)	Tertiary – Miocene	Sand and gravel	Class 2/Mammals	48.4 to 48.5
Ludlow Member of Fort Union Fm. (Tfl)	Tertiary - Paleocene	Primarily sandstone, siltstone, mudstone, carbonaceous shale and lignite, up to 460 feet thick.	Class 5/Mammals.	200.9 to 203.6 240.7 to 244.6 244.7 to 250.9 251.2 to 251.2 251.4 to 251.6 252.4 to 253.9 254.0 to 254.1 254.4 to 254.5 269.6 to 270.4 272.7 to 282.5
Tongue River Member of Fort Union Fm. (Tftr)	Tertiary - Paleocence	Poorly cemented sandstone interbedded with siltstone and mudstone and coal. Some coals have burned to form “clinker beds”. Commonly eroded to badland topography. Thickness 400 to 650 feet.	Class 5/Plants, Mammals and mollusks.	129.0 to 200.9 203.6 to 240.7
Lebo Member of Fort Union Fm. (Tfle)	Tertiary - Paleocene	Sandstone, siltstone, and mudstone interbedded with carbonaceous shale. Forms rolling hills. Thickness 180-300	Class 5/Mammals.	119.7 to 121.3 123.6 to 123.9

Table 3.3-1 Summary of Geological and Paleontologic Resources Along the Proposed Route in Montana

Geologic Formation (Fm)/Deposit (Map Symbol)	Period	Description	BLM Potential Fossil Yield Classification System (PFYC) Class/Types of Fossils	Milepost
		feet.		124.0 to 124.5 125.0 to 125.0 128.0 to 129.0
Tullock Member of Fort Union Fm. (Tft)	Tertiary- Paleocene	Sandstone, claystone, and carbonaceous shale and thin isolated coal beds. Thickness 200-300 feet.	Class 5/Invertebrates, and vertebrates (fish, amphibians, reptiles, birds, mammals).	105.4 to 105.5 105.6 to 107.3 112.5 to 112.6 112.7 to 113.4 113.6 to 113.6 114.9 to 115.2 116.4 to 116.5 116.5 to 119.7 121.3 to 123.6 123.9 to 124.0 124.5 to 125.0 125.0 to 128.0
Hell Creek Fm/Fox Hills Fm. (Khc/Kfh)	Upper Cretaceous	Hell Creek Fm. - Shale, mudstone, and lenticular coal beds. Forms badland topography. Contact with underlying Fox Hills Fm. is gradational and sometimes not distinguishable. Thickness 300-400 feet. Fox Hills Fm. – Thin interbedded sandstone, siltstone, and clay grading	Hell Creek - Class 5/ Large numbers of plants and terrestrial vertebrates (fish reptiles, dinosaurs), invertebrates (molluskes), and plants.	91.5 to 105.4 105.5 to 105.6 107.3 to 112.5 112.6 to 112.7 113.4 to 113.6 113.6 to 114.9

Table 3.3-1 Summary of Geological and Paleontologic Resources Along the Proposed Route in Montana

Geologic Formation (Fm)/Deposit (Map Symbol)	Period	Description	BLM Potential Fossil Yield Classification System (PFYC) Class/Types of Fossils	Milepost
		upward to poorly consolidated sandstone. Thickness 200 feet.	Fox Hills - Class 3/ Contains marine vertebrates and invertebrates. Lesser occurrence of plants and terrestrial vertebrates (reptiles, dinosaurs, mammals).	115.2 to 116.4 116.5 to 116.5 244.6 to 244.7 250.9 to 251.2 251.2 to 251.4 251.6 to 252.4 253.9 to 254.0 254.1 to 254.4 254.5 to 257.9 258.9 to 269.6 279.4 to 272.7
Bearpaw Fm./Pierre Shale (Kb/Kp)	Upper Cretaceous	Bentonitic mudstone and shale with fossiliferous concretions containing. Thickness 1100 feet or more. The Pierre shale is the eastern equivalent to the Claggett, Judith River, and Bearpaw Fms.	Class 3/Commonly contains marine invertebrates (ammonites and pelecypods) and vertebrates	0.0 to 1.1 3.5 to 21.3 21.7 to 23.7 30.6 to 36.0 36.3 to 37.1 44.8 to 44.8 45.1 to 48.4 48.5 to 91.5 257.9 to 258.9
Judith River Fm. (Kjr)	Upper Cretaceous	Sandstone, siltstone, mudstone, shale, and coal or lignite. Thickness up to 600	Class 5/ Contains a variety of vertebrate fossils including	1.1 to 3.5

Table 3.3-1 Summary of Geological and Paleontologic Resources Along the Proposed Route in Montana

Geologic Formation (Fm)/Deposit (Map Symbol)	Period	Description	BLM Potential Fossil Yield Classification System (PFYC) Class/Types of Fossils	Milepost
		feet.	fish, turtles, crocodiles, dinosaurs, and mammals. Also invertebrates and plants.	21.3 to 21.7 23.7 to 30.6 36.0 to 36.3 37.1 to 38.9 39.4 to 40.1 41.4 to 44.5 44.8 to 45.1
Claggett Shale (Kcl)	Upper Cretaceous	Shale and siltstone with bentonite beds near the base. Thickness up 200 to 500 feet.	Class 3a[1]/Reptiles, dinosaurs, plants and invertebrates.	38.9 to 39.4 40.1 to 41.4

Sources: Bergantino (1999, 2001, 2002); BLM (1992; 2006); Condon S.M. (2000); Gill and Cobban (1966); SWCA (2008); Vuke and Colton (2003); Vuke, et al. (2003); Vuke, et al. (2001); Wilde and (2004); and Wilde and Smith (2003a, b).
1. Not surveyed by SWCA (2008). Classification based on description in BLM (2006).

3.3.1.5 Geologic Hazards

Seismic Hazards

There are three major phenomena associated with seismic hazards: faults, seismicity, and ground motion. The following describes the potential for seismic hazard occurrences in the Project area. Section 4.2.2 discusses the potential impacts seismic hazards to the proposed Project.

Faults are dislocations where blocks of earth material on opposite sides of the faults have moved in relation to one another. Rapid slippage of blocks of earth past each other can cause energy to be released, resulting in an earthquake. The Weldon-Brockton fault zone or lineament has surface expression in the Brockton-Froid Fault that has been defined as Late Quaternary in age (Figure 3.3-2) (USGS and Montana Bureau of Mines and Geology 2006). Late Quaternary means that movement occurred in the last 300,000 years. The fault was mapped on-trend with the Weldon-Brockton lineament 50 miles east of the proposed route in Roosevelt County, just north of Culbertson, Montana. The fault was mapped on the basis of surface features, shallow auger holes, and evidence obtained from oil and gas exploration data (Wheeler 1999). There is an indication of offset in older strata, but no evidence that would lead to a conclusion of movement on the fault in the last 10,000 years. An active fault is one in which movement can be demonstrated to have taken place within the last 10,000 years (USGS 2008b). Some researchers think the feature is not a fault, but an erosion feature in the glacial deposits that cover the area.

Seismicity concerns the intensity, frequency, and location of earthquakes in a given area. Eastern Montana historically has little earthquake activity (USGS 2008c,d). From 1973 to 2007, east of longitude 110 degrees west, there were 14 earthquakes; seven were not assigned magnitudes. The other seven had magnitudes of 4.1 or less.

Ground motion hazards result when the energy from an earthquake is propagated through the ground. The USGS ground motion hazard mapping indicates that potential ground motion hazard in the proposed Project area is low. The hazard map used estimates peak ground acceleration expressed as a percentage of the acceleration of gravity with a two percent probability of exceedance in 50 years (Frankel et al 1997; Peterson et al. 2008).

Landslides

Landslide is a term used for various processes involving the movement of earth material down slopes (USGS 2004). Landslides can occur in a number of different ways in different geological settings. Large masses of earth become unstable and gravity pulls them downhill. The instability can be caused by a combination of steep slopes, periods of high precipitation, undermining of support by natural processes (stream erosion), or unintentional undercutting or undermining the strength of unstable materials in the construction of roads and structures.

Cretaceous and Tertiary rocks in the Missouri River Plateau have high clay content and upon weathering can be susceptible to instability in the form of slumps and earth flows. Landslide potential is enhanced on steeper slopes. Formations that are especially susceptible are the Cretaceous-aged Claggett, Bearpaw, and Pierre Shales as well as shales in the Tertiary Fort Union Formation (Radbruch-Hall et al. 1982). These shale units can contain appreciable amounts of bentonite, a rock made up of montmorillonite clay that has deleterious properties when exposed to moisture.

The Project is located in areas of varying landslide susceptibility and recorded incidence (Table 3.3-2). Landslide deposits are present in limited areas along the sides of drainages.

Landslide susceptibility “refers to the likelihood of a landslide occurring in an area on the basis of terrain conditions,” but does not take into account the probability of occurrence (National Research Council 2004).

Incidence is based on the percentage of area involved in movement (low: less than 1.5 percent; moderate: 1.5 to 15 percent, and high: more than 15 percent) (Radbruch-Hall et al. 1982).

Table 3.3-2 Landslide Incidence and Susceptibility

Pipeline Segment (Approximate Mileposts)	Landslide Incidence	Landslide Susceptibility	Approximate Mileposts with > 15% Slope Underlain by Cretaceous Shale or Mapped Landslide Deposit
0.0 to 82.3	Low	High	13.7 to 14.0; 16.3 to 16.6; 21.5 to 21.7; 25.0 to 25.5; 26.0 to 26.4; 36.1 to 36.2; 38.0 to 39.0; 40.0 to 40.0; 41.0 to 41.0; 48.0 to 48.4; 55.0 to 55.2; 81.9 to 82.0
82.3 to 90.3	Low	Low	
90.3 to 116.5	Moderate	High	90.4 to 91.5; 93.9 to 94.1; 101.9 to 102.1; 112.5 to 112.6
116.5 to 282.6	Low	Low	
Sources: Bergantino (1999, 2001, 2002); Condon S.M. (2000); National Atlas (2008); Radbruch-Hall et al. (1982); Vuke and Colton (2003); Vuke, et al. (2003); Vuke, et al. (2001); Wilde and (2004); and Wilde and Smith (2003a, b).			

Of particular concern for slope stability are Cretaceous shales present on slopes greater than 15 percent (MDEQ 2004). In the Project area, steeper slopes occur along the Missouri River Valley walls and larger tributaries (Radbruch-Hall et al. 1982). Landslides are documented at MP 39 and 90.4 to 91.5. At both of these locations, slumps occurred at major drainages, the former at the Willow Creek crossing, and the latter on the south side of the Missouri River Valley (Bergantino 1999, 2002). Table 3.3-3 presents places on the proposed route where slopes exceed 15 percent and are underlain by Cretaceous shale.

Table 3.3-3 Locations in Montana with slopes >15% Slopes Underlain by Cretaceous Shale

County	Beginning Milepost	Ending Milepost	Miles
Phillips	13.8	13.8	< 0.1
Phillips	16.3	16.6	0.3
Phillips	21.2	21.2	< 0.1
Phillips	25.2	25.4	0.2
Valley	26.1	26.1	< 0.1
Valley	33.9	34.0	0.1
Valley	36.2	36.2	< 0.1
Valley	38.7	38.8	0.1
Valley	38.9	39.0	0.1
Valley	39.5	39.6	0.1
Valley	40.1	40.2	0.1
Valley	41.0	41.1	0.1
Valley	41.5	41.6	0.1
Valley	43.1	43.1	<0.1

Table 3.3-3 Locations in Montana with slopes >15% Slopes Underlain by Cretaceous Shale

County	Beginning Milepost	Ending Milepost	Miles
Valley	46.8	46.8	<0.1
Valley	48.2	48.3	0.1
Valley	48.4	48.5	0.1
Valley	51.3	51.3	<0.1
Valley	53.1	53.2	0.1
Valley	53.7	53.7	<0.1
Valley	55.0	55.1	0.1
Valley	55.1	55.2	0.1
Valley	66.8	66.8	<0.1
Valley	77.8	77.8	<0.1
Valley	78.1	78.1	<0.1
Valley	82.2	82.2	<0.1
McCone	91.4	91.4	<0.1
McCone	91.4	91.6	0.2
McCone	91.6	91.6	<0.1
McCone	91.8	91.9	0.1
McCone	92.0	92.0	<0.1
McCone	93.4	93.4	<0.1
McCone	93.5	93.5	<0.1
McCone	93.7	93.7	<0.1
McCone	93.8	93.8	<0.1
McCone	94.4	94.7	0.3
McCone	94.8	94.8	<0.1
McCone	94.9	94.9	<0.1
McCone	95.0	95.1	0.1
McCone	95.2	95.2	<0.1
McCone	95.3	95.5	0.2
McCone	95.9	95.9	<0.1
McCone	96.6	96.7	0.1
McCone	96.8	96.9	0.1
McCone	97.0	97.1	0.1
McCone	98.6	98.7	0.1
McCone	99.0	99.0	<0.1
McCone	99.5	99.5	<0.1
McCone	100.9	100.9	<0.1
McCone	101.0	101.0	<0.1
McCone	101.6	101.6	<0.1

Table 3.3-3 Locations in Montana with slopes >15% Slopes Underlain by Cretaceous Shale

County	Beginning Milepost	Ending Milepost	Miles
McCone	102.1	102.2	0.1
Fallon	254.3	254.3	<0.1
Fallon	262.5	262.5	<0.1
Fallon	269.2	269.2	<0.1
Fallon	269.2	269.3	0.1
Fallon	269.3	269.3	<0.1
Fallon	270.5	270.5	<0.1
Fallon	270.9	270.9	<0.1
Fallon	271.9	272.0	0.1

Source: SSURGO (USGS 2007) and NED (USGS 1999)

Subsidence

No ground subsidence or karst hazards are present in the vicinity of the proposed route (National Atlas 2008).

Flooding

In general, seasonal flooding hazards exist where the proposed pipeline route will cross rivers and streams, and flash flooding hazards exist where the pipeline will cross localized drainages. The proposed pipeline route will cross 22 perennial streams, 98 intermittent streams, and 225 ephemeral drainages, all of which are locations where seasonal or flash flooding could occur. The stream and drainage crossings are listed in Appendix E.

Swelling Clays

The bentonite layers in the Claggett, Bearpaw, and Pierre Shales may present hazards associated with swelling clays (Olive et al. 1989). These formations are considered to have "high swelling potential." Bentonite significantly expands in volume when wet. When bentonite layers are exposed to successive cycles of wetting and drying, they swell and shrink and the soil fluctuates in volume and strength.

3.3.2 South Dakota– Steele City Segment

3.3.2.2 Geology

The Project is located in the Great Plains physiographic province (Fenneman 1928). In South Dakota, the Great Plains is divided into two major sections, the Glaciated Missouri Plateau and the Unglaciated Missouri Plateau. The Missouri Plateau is essentially a dissected plateau characterized by badlands, buttes, mesas, and exhumed mountain ranges such as the Black Hills. The proposed route is entirely within the Unglaciated Missouri Plateau. Elevations along the proposed route range from just over 3,000 feet amsl in the northwestern part of the state to around 1,800 feet amsl in the White River Valley.

The surficial deposits are primarily composed of Quaternary alluvium, colluvium, alluvial terraces, and eolian deposits (sand dunes). The alluvium primarily occurs in modern channels and floodplains, but also is present in older river terraces.

The bedrock geology consists of Upper Cretaceous and Tertiary rocks. Table 3.3-4 provides a description of the bedrock rock units that are crossed by the proposed route. The Pierre Shale was deposited under marine

conditions. The Fox Hills Formation is a marginal marine sandstone with widespread distribution throughout the Northern Rocky Mountain basins from northeast Colorado to Montana. Overlying the Fox Hills Formation is the Hell Creek Formation which was deposited under non-marine conditions in depositional environments of river channels, floodplains, and lakes.

The Ludlow Formation of the Tertiary Fort Union Group was deposited under non-marine conditions similar to the Hell Creek Formation in river channels, floodplains, and lakes. Both the Hell Creek and Fort Union Formations appear to have been sourced by uplift and erosion of emerging Rocky Mountains to the west and south of the Project area (McDonald 1971).

The Ogallala Group was deposited as a result of uplift and erosion of the Rocky Mountains. Material that was eroded from the mountains was transported to the east by streams and wind.

Major structural features crossed by the proposed route include the Williston Basin, the Sioux Arch or Ridge, and the Salina Basin. In the northwestern portion of the state, the route crosses the southern part of the Williston Basin, a major structural basin that covers northeast Montana, most of North Dakota, and northwest South Dakota (Figure 3.3-2) (Peterson and MacCary 1987). The Williston Basin also extends north into Saskatchewan and Manitoba in southern Canada. The basin contains about 15,000 feet of Paleozoic through Tertiary sedimentary rock. The center of the basin is located in western North Dakota so the rocks dip gently towards the north in the Project area. Near Midland, South Dakota, the route leaves the Williston Basin and crosses the Sioux Arch to around the White River. The Sioux Arch is a buried ridge formed on the Precambrian basement rocks that extends east to west from Minnesota across southeast South Dakota (Gries 1996). South of the White River to the Nebraska state line, the route crosses into the northern portion of the Salina Basin, a sedimentary basin that underlies most of eastern Nebraska.

3.3.2.3 Mineral Resources

The major mineral resources in the Project area are sand, gravel, oil, gas, and coal (South Dakota Geological Survey/USGS 2005). Sand and gravel are mined in every county in South Dakota and deposits are found in alluvium and terraces. In northwest South Dakota, scoria (rock baked from burned coal beds) is mined locally. A gravel pit was identified approximately 0.5 mile from the proposed route northeast of milepost 552.

Most of the oil and gas production in South Dakota is in the Williston Basin. The Williston Basin is a major oil and gas producing basin. In the United States portion of the basin, total production to the end of 2007 was approximately 2.5 billion barrels of oil and 470 billion cubic feet of gas (Burke 2006; Montana Board of Oil and Gas 2007; North Dakota Industrial Commission 2007; South Dakota Oil and Gas Section 2008). In the South Dakota portion of the Williston Basin, cumulative oil and gas production is 40.5 million barrels of oil and 192 million cubic feet of gas, primarily from Paleozoic rocks. The proposed route passes through the Buffalo Field in Hardin County. Appendix J contains a list of wells that are within 1,320 feet of the proposed ROW.

There are no coal mines on the proposed route, but there are coal-bearing formations including the Fort Union Formation (primarily lignite) and the Hell Creek Formation in the northwest corner of the state (Averitt 1963). The proposed route crosses approximately 2 miles of the coal-bearing Ludlow Member of the Fort Union Formation, and limited coals in the Hell Creek Formation, with low potential for mineable coal (Erickson, 1956). Based on today's economics, potential for the development of mines in the state is low.

In northwest South Dakota, uranium-bearing lignites are present in the Fort Union Formation in an area called the Cave Hills (Pipiringos et al. 1965). Lignites were mined in the 1950s and 1960s at South Cave Hills, North Cave Hills, and Slim Buttes, but no mining has taken place since 1964 (Stone et al. 2006). The proposed route does not cross mined out areas. The mining method used was to strip off the overburden to obtain access to the lignite. The mined areas were not reclaimed and as a result, sediment-bearing runoff deposited spoil material in drainages immediately adjacent to the buttes where mining took place. The proposed route passes a few miles south of Slim Buttes where uranium-bearing lignite mining took place. The proposed route crosses the Spring Creek drainage at MP 347.2 to MP 348.2. Tributaries of Spring Creek head in an area of

Slim Buttes in the vicinity lignite mine workings. Recent sampling in a study conducted by the South Dakota School of Mines and Technology indicates that there is limited concern for contaminated sediments in the Spring Creek drainage (Stone 2008).

3.3.2.4 Paleontological Resources

The fossil potential of the various formations crossed by the Project is provided in Table 3.3-4. Field surveys were conducted on federal lands in Montana and South Dakota in 2008, and results are provided in Appendix G. Potential rankings along the entire route are based on rankings of the same formations along the proposed route in Montana that were previously surveyed and classified. Information derived from published sources was used to describe the overview of fossil potential of the formations crossed in South Dakota. The Hell Creek Formation and the Ludlow Member of the Fort Union Formation have high fossil potential in the Project area. In northwest South Dakota, the Hell Creek Formation yielded valuable dinosaur bones including from a triceratops, the South Dakota State fossil (Bjork 1995). The Ludlow Member also has high fossil potential and may yield mammals, plants, and invertebrates (SWCA 2008). The Fox Hills Formation has moderate potential and in the Project area has been found to contain invertebrates and plants (Lange 1967). Concretions containing invertebrates were found in the Pierre Shale.

Table 3.3-4 Summary of Geologic and Paleontologic Resources Along the Proposed Route in South Dakota

Geologic Formation/Deposit (Map Symbol)	Period	Description	Fossil Potential/Fossil Types	Milepost
Alluvium/colluvium, landslides, and other unconsolidated deposits (e.g. sand dunes)	Quaternary (Pleistocene to Recent)	Sand, gravel and clay	Low/Mammals	Occur sporadically throughout route, alluvium primarily occurs along drainages and river crossings.
Ogallala Group	Pliocene and Miocene	Well to poorly consolidated sandstone, mudstone, and conglomerate. Contains occasional bentonite layers, up to 300 feet thick.	Medium/Mammals	569.8 to 578.9 579.5 to 589.6
Ludlow Member of Fort Union Fm.	Tertiary - Paleocene	Primarily sandstone, siltstone, mudstone, carbonaceous shale and uraniferous lignite, up to 350 feet thick.	High/ Mammals, plants, invertebrates.	282.5 to 284.7
Hell Creek Fm	Upper Cretaceous	Hell Creek Fm. – Lenticular sandstone, sandy shale, mudstone, and lignite beds. Forms badland topography. Contains dinosaur bones. Thickness 400 feet.	High/Mammals (important dinosaur locatlities)	284.7 to 387.1
Fox Hills Fm.	Upper Cretaceous	Sandstone and siltstone interbedded with shale. Thickness 400 feet.	Moderate/ Vertebrates and plants	387.1 to 397.9 400.7 to 417.9
Pierre Shale	Upper	Bentonitic mudstone and shale	Moderate/Marine	397.9 to 400.7

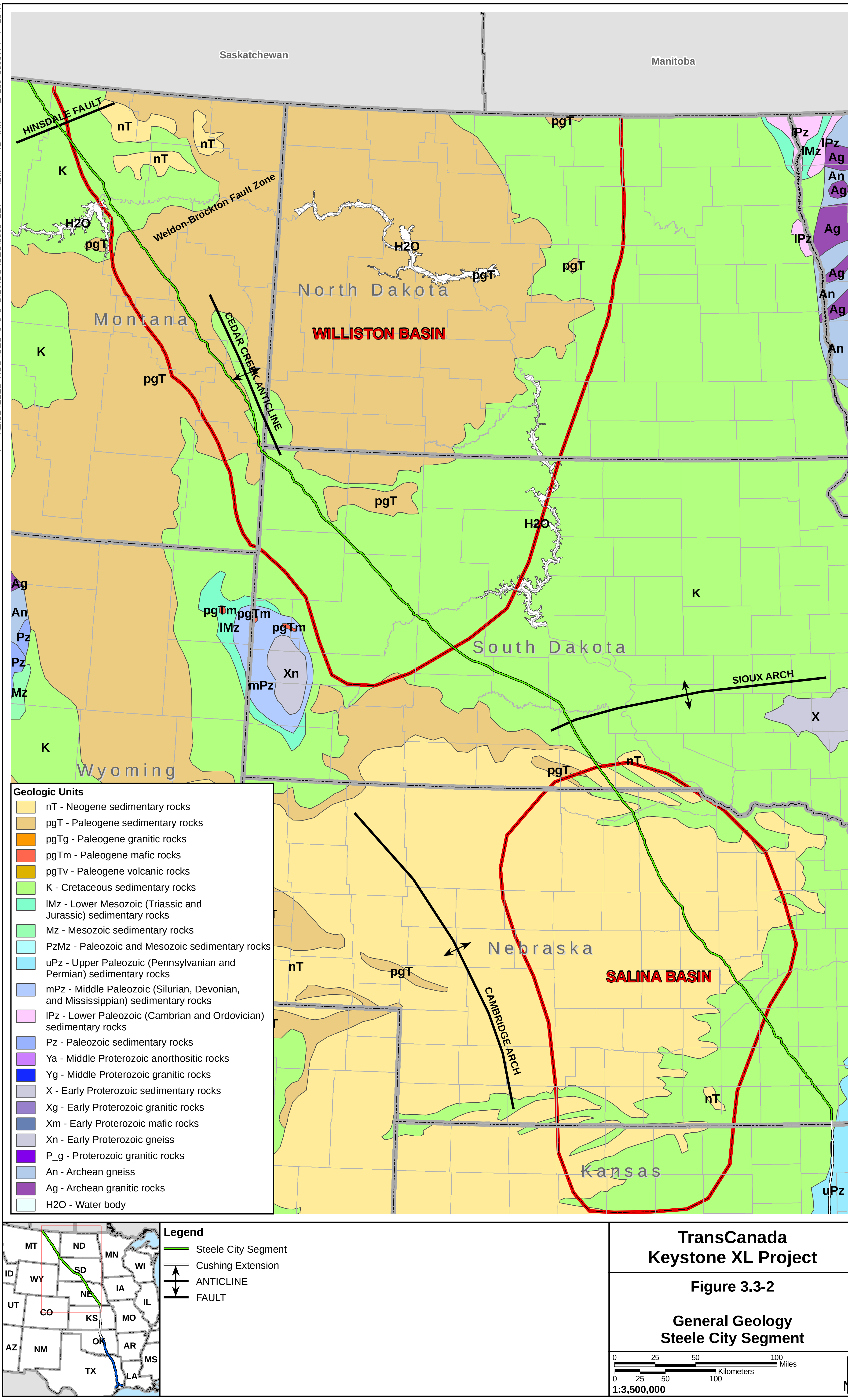


Figure 3.3-2

General Geology
Steele City Segment

Table 3.3-4 Summary of Geologic and Paleontologic Resources Along the Proposed Route in South Dakota

Geologic Formation/Deposit (Map Symbol)	Period	Description	Fossil Potential/Fossil Types	Milepost
	Cretaceous	with fossiliferous concretions. Up to 3,000 feet thick.	invertebrates	417.9 to 569.8 578.9 to 579.5 589.6 to 595.2

Source: Bjork (1995); Harksen, (1964); Martin et al. (2004); Merewether (1964); SWCA (2008).

3.3.2.5 Geologic Hazards

Seismic Hazards

Seismicity concerns the intensity, frequency, and location of earthquakes in a given area. South Dakota historically has little earthquake activity USGS 2008). From 1973 to present there were 30 earthquakes recorded in South Dakota, the strongest being 4.2 in magnitude. There are no recorded epicenters from 1973 to present along the proposed route.

The USGS ground motion hazard mapping indicates that potential ground motion hazard in the proposed Project area is low. The hazard map used estimates peak ground acceleration expressed as a percentage of the acceleration of gravity with a 2 percent probability of exceedence in 50 years (Frankel et al 1997; Peterson et al. 2008).

Landslides

Cretaceous and Tertiary rocks in the Missouri River Plateau have high clay content and upon weathering can be susceptible to instability in the form of slumps and earth flows. Landslide potential is enhanced on steeper slopes. Formations that are especially susceptible are the Cretaceous Hell Creek and Pierre Shale as well as shales in the Tertiary Fort Union Formation (Radbruch-Hall et al. 1982). These units can contain appreciable amounts of bentonite, a rock made up of montmorillonite clay that has deleterious properties when exposed to moisture.

The Project is located in areas of varying landslide susceptibility and recorded incidence (Table 3.3-5). Landslide susceptibility “refers to the likelihood of a landslide occurring in an area on the basis of terrain conditions,” but does not take into account the probability of occurrence (National Research Council 2004). Incidence is based on the percentage of area involved in movement (low: less than 1.5 percent; moderate: 1.5 to 15 percent, and high: more than 15 percent) (Radbruch-Hall et al. 1982).

Much of the areas on Table 3.3-5 that are indicated as having high susceptibility to landslides are underlain by the Pierre Shale. The Pierre Shale can become quite unstable, especially during periods of anomalous periods of precipitation when the swelling clays in the shale cause severe instability along ravines and drainages (Iles 2008).

Subsidence

No ground subsidence or karst hazards are present in the vicinity of the proposed route (National Atlas 2008).

Table 3.3-5 South Dakota Landslide Incidence and Susceptibility

Pipeline Segment (Approximate Mileposts)	Landslide Incidence	Landslide Susceptibility
283.0 to 354.0	Low	Low
354.0 to 373.0	Low	High
373.0 to 394.0	Low	Low
394.0 to 547.0	Low	High
547.0 to 575.0	Low	Low
575.0 to 584	Low	High
Sources: National Atlas (2008); Radbruch-Hall et al. (1982).		

Flooding

The proposed pipeline route will cross 12 perennial streams, 109 intermittent streams, and 182 ephemeral drainages, all of which are locations where seasonal or flash flooding could occur. The stream and drainage crossings are listed in Appendix E. The Steele City Segment has no pump stations currently located in identified flood zones.

Swelling Clays

The bentonite layers in the Pierre Shale may present hazards associated with swelling clays (Olive et al. 1989). These formations are considered to have “high swelling potential.” Bentonite has the property whereby when wet, it expands significantly in volume. When bentonite layers are exposed to successive cycles of wetting and drying, they swell and shrink, the soil fluctuates in volume and strength.

3.3.3 Nebraska – Steele City Segment

3.3.3.2 Geology

The proposed pipeline passes through the eastern third of Nebraska, in the Great Plains physiographic region. This part of the state is almost entirely covered by Quaternary deposits. To the north some older Tertiary bedrock deposits are exposed and the yet older, underlying Cretaceous bedrock is exposed along river valleys where the river has cut down into the bedrock. Elevations along the proposed route range from about 2,200 feet in the north to 1,400 feet near the Kansas state line.

Surficial geologic deposits along the proposed route include glacial till, loess deposits, and the Sand Hills. Table 3.3-6 provides a description of the surficial units. From the Loup River south to the Kansas state line, the proposed pipeline passes through glacial till deposits. During Pleistocene times, a lobe of ice extended south along the present day Missouri River. The glacier deposited a wide range of material from clay to large boulders. These glacial deposits are called till and form the rolling hills of southeast Nebraska. From a few miles north of Greeley, Nebraska, south to the Loup River, loess deposits are the predominant surface deposit. Loess is formed by wind blown dust, which over time can accumulate to great thicknesses (50 feet or more in this area). Loess can form nearly vertical faces at road cuts and river-cut banks. However, it has a relatively low cohesive strength and becomes much more easily eroded when disturbed. Between Stuart and Greeley, the proposed pipeline passes through the eastern end of the Sand Hills. The Sand Hills are the largest dune

field in the Western Hemisphere, covering approximately 20,000 square miles (Maher et al. 2003). As the name suggests, the Sand Hills are comprised mainly of well sorted sands that form dunes and sand sheets. The dunes are stabilized by varying amounts of vegetation. Blowouts may occur where the vegetation has been disturbed.

The bedrock geology along the proposed route consists of Cretaceous and Tertiary sedimentary rocks; a summary of these units is provided in Table 3.3-6. These formations were deposited in the Cretaceous period, during which time a large inland sea covered much of the Western and Midwestern US. The Dakota Group is the oldest of the Cretaceous bedrock units and is present in the southern part of the proposed route. It consists of sandstones and shales deposited in a marginal marine environment. Overlying the Dakota Group is the Greenhorn Limestone/Graneros Shale Formation which was deposited in slightly deeper water conditions. Above this is the Carlile Formation, which consists of shale, limestone, and sandstone. The Niobrara Formation is the next youngest unit and consists of chalk, limestone, and shale. Limestone is susceptible to karst formation, which occurs when rock is dissolved by water, leaving holes and caves, which can cause subsidence at the surface. The Pierre Shale is the youngest and uppermost of the Cretaceous units. It consists of dark gray shale and was deposited in deepwater conditions. It also contains some layers rich in volcanic ash from eruptions in the western US. The Pierre Shale is exposed in the northern part of Nebraska where the Keya Paha and Niobrara rivers eroded overlaying deposits. It is susceptible to slumps and slides and cannot support slopes much over 10 percent. The layers rich in volcanic ash are particularly weak (Maher et al. 2003).

The Tertiary Ogallala Group consists of sediments eroded from the Rocky Mountains as those mountains were uplifted. The Ogallala generally extends from the South Dakota state line to the Loup River. The Ogallala is covered by the Sand Hills over most of this area, but is exposed along the northern part of the proposed route from the South Dakota state line to Stuart.

Nebraska is part of the stable interior craton (an old and stable part of the continental crust) and has not experienced major structural deformation for many millions of years. The major structural features in the vicinity of the Project in Nebraska are the Cambridge Arch and the Salina Basin (Figure 3.3-2) (Maher et al. 2003). Further from the Project, in southeastern Nebraska, minor earthquakes occur along the Humboldt fault zone and Nemaha uplift. There are faults in the basement of the Salina Basin in the central part of the state that may be responsible for "micro-earthquakes" (Steeples and Brosius 1996). The proposed route is on the east flank of the Cambridge Arch where it enters the state on the north and crosses the Salina Basin in the central and southern parts of the state.

3.3.3.3 Mineral Resources

The major mineral resource in the Project area is aggregate (sand and gravel) for road construction, concrete, and other building uses. Near the southern end of the proposed route through Nebraska, shales and clays in the Dakota Group have been mined for making brick. Volcanic ash also was mined in this area in the past. Near Tobias, the Greenhorn Limestone Formation was mined for agricultural lime. Along the northern part of the route, the sandstones of the Ogallala Formation were quarried for sandstone for use in road material (National Atlas 2008a). There is no oil, natural gas, coal, or mineral mining activity along the proposed route (NOGCC 2008; National Atlas 2008a).

3.3.3.4 Paleontological Resources

Fossils that may potentially be found in the upper Cretaceous rocks include ammonites, gastropods, mosasaurs fish, mosasaurs, bivalves, sea turtles, and sharks. The Tertiary rocks may contain fossils of horses, rhinoceroses, proboscideans, mammoths, and other ruminants (Table 3.3-6).

Table 3.3-6 Summary of Geologic and Paleontologic Resources Along the Proposed Route in Nebraska

Geologic Formation/Deposit (Map Symbol)	Period	Description	Fossil Potential/ BLM Condition	Milepost
Surficial Geologic Deposits				
Sand Hills	Quaternary-Holocene	Well sorted sand, forms dunes and sand sheets	None	629 to 707
Loess	Quaternary-Pleistocene	Wind-blown dust deposits	None	707 to 737
Glacial Till	Quaternary-Pleistocene	Clay, silt, sand, cobbles, and boulders; forms rolling hills	None	737 to 850
Bedrock Geology				
Ogallala Group	Tertiary – Miocene	Silt, sand, sandstone, gravel and conglomerate. Forms erosion-resistant "mortar beds" in some locations.	Horses, rhinoceroses, proboscideans, mammoths, other ruminants	595 to 598 603 to 612 616 to 737 741 to 744
Pierre Shale	Upper Cretaceous	Dark gray to black fissile clay shale. Locally grades to thin beds of calcareous, silty shale or claystone, marl, shaly sandstone, and sandy shale. Prone to slumping, especially in beds rich in volcanic ash.	Ammonites, gastropods, bivalves, mosasaurs fish, mosasaurs, bivalves, sea turtles, sharks	598 to 603 612 to 616
Niobrara Formation	Upper Cretaceous	Chalk, limestone and shale, contains many fossil clams, oysters, and formanifera.		737 to 741 744 to 757 760 to 766 772 to 776
Carlile Shale	Upper Cretaceous	Shale, limestone, and sandstone, locally contains ironstone concretions		757 to 760 766 to 772 776 to 796 804 to 805 813 to 818
Greenhorn Limestone	Upper	*Greenhorn Limestone*- limestone		796 to 798

Table 3.3-6 Summary of Geologic and Paleontologic Resources Along the Proposed Route in Nebraska

Geologic Formation/Deposit (Map Symbol)	Period	Description	Fossil Potential/ BLM Condition	Milepost
and Graneros Shale	Cretaceous	interbedded with argillaceous limestone, marl and calcareous shale; contains Inoceramus fossils. Approx. max thickness 30 ft. *Graneros Shale*- marine shale.		802 to 804 805 to 807 809 to 813 818 to 823
Dakota Group	Lower Cretaceous	White, light-gray, brownish-gray, yellow, redish-brown, and red sandstone and shale; locally contains gravel near base.	Flowering plants, fossilized tree trunks	798 to 802 807 to 809 823 to 850

Sources: Burchett 1986, Maher et al. 2003, Joeckel 2008

3.3.3.5 Geologic Hazards

Seismic Hazards

As described above, Nebraska is in a relatively quiet and stable part of the continent. The ancient Nemaha uplift the Humboldt fault zone and deep sealed faults in the Salinas Basin are thought to be related to the few very minor earthquakes that occur. There are no active surficial faults along the proposed route through Nebraska (Crone and Wheeler 2000, USGS 2006).

Eastern Nebraska historically has little earthquake activity (USGS 2008a). From 1973 to 2008, east of longitude 97 degrees west, there were 11 earthquakes, ranging in magnitude from 2.8 to 4.3.

The US Geological Survey ground motion hazard mapping indicates that potential ground motion hazard in the proposed Project area is low. The hazard map used estimates peak ground acceleration expressed as a percentage of the acceleration of gravity with a 2 percent probability of exceedence in 50 years (USGS 2008b).

Landslides

Cretaceous and Tertiary rocks in the Missouri River Plateau have high clay content and upon weathering can be susceptible to instability in the form of slumps and earth flows. Landslide potential is enhanced on steeper slopes. The Cretaceous Pierre Shale is especially susceptible to slumping. The Pierre contains some layers rich in volcanic ash, which weakens the rock and makes it even more susceptible to slumping. The Pierre can also contain appreciable amounts of bentonite, which can expand dramatically when exposed to moisture. Along the proposed route, the Pierre is only exposed at the surface along the Keya Paha and Niobrara Rivers. These areas are rated as having a high susceptibility to sliding, but a low incidence of occurring (National Atlas 2008a). For information on unstable loess soil materials see Section 3.4.4.

Subsidence

Karst hazards are present in the Niobrara formation. However 50 feet of overlying sediment typically covers the Niobrara, preventing any significant subsidence (National Atlas 2008a, b).

Flooding

In general, seasonal flooding hazards exist where the proposed pipeline route will cross rivers and streams, and flash flooding hazards exist where the pipeline will cross localized drainages. The proposed pipeline route will cross 20 perennial streams, 46 intermittent streams, and 83 ephemeral drainages, all of which are locations where seasonal or flash flooding could occur. The stream and drainage crossings are listed in Appendix E. The Steele City Segment has no pump stations currently located in identified flood zones.

3.3.4 Kansas

3.3.4.2 Geology

In Kansas, the Project will consist of two new pump stations along the Keystone Cushing Extension route in Clay and Butler counties. These counties in Kansas are in an area referred to as the Flint Hills. The Flint Hills are made up of a series of north-south trending escarpments formed by the erosion of the outcrops of gently west-dipping Permian sedimentary rocks. The upland areas of the Flint Hills are commonly covered with cherty gravels which are more resistant to erosion and thereby forming the prominent escarpment (KGS 1999b). Karst is not present within these counties (Davies et al. 1984; USGS 2000).

Elevations associated with construction of pump stations ranges from 1,150 to over 1,400 feet amsl. Some relief is provided at major drainages where elevation changes are commonly around 100 feet, but are not steep.

In the area of the Clay County pump station construction there are relatively thick (greater than 30 feet) deposits of loess (Frye and Leonard 1952). In Butler County, south of the glaciated area, the dominant surficial materials are alluvium and colluvium and, as mentioned above, cherty gravels are present in upland areas of the Flint Hills.

The new pump stations are situated within rocks of the Permian Council Grove, Chase, and Sumner Groups, which are composed primarily of limestone and shale (SGSK 1964).

3.3.4.3 Mineral Resources

The major mineral resources in northeast Kansas are sand, gravel, and crushed stone (USGS 2004d). Pump stations will be situated in the Forest City Basin (Brooks et al. 1975). Coal beds are present in Pennsylvanian rocks but are generally too deep to mine, although there is potential for coal bed methane production (Rice 1995).

The pump station location in Butler County is in the vicinity of, but not in close proximity to impact a number of oil and gas fields (KGS 2005c). In addition to oil and natural gas, sand, gravel, crushed stone, and dimension limestone are important mineral resources present within Kansas in the general Project area although construction of new pump stations will not impact current mineral production activities (USGS 2004d).

3.3.4.4 Paleontological Resources

Sedimentary rocks from the Permian time was not conducive to abundant life, but fossils of fish such as shark may be found in addition to invertebrates, including corals, brachiodpods, ammonoids, and gastropods (KGS 2005a). It is also possible that the surficial unconsolidated deposits in the area have the potential to contain typical ice-age large vertebrates such as mammoths, mastodons, camels, and saber-toothed tigers (Paleontology Portal 2003). The unconsolidated deposits also contain invertebrates such as mollusks which have been used to correlate different glacial episodes to various deposits (Frye and Leonard 1952).

3.3.4.5 Geologic Hazards

No geologic hazards have been identified at locations for construction of new pump stations in Kansas.

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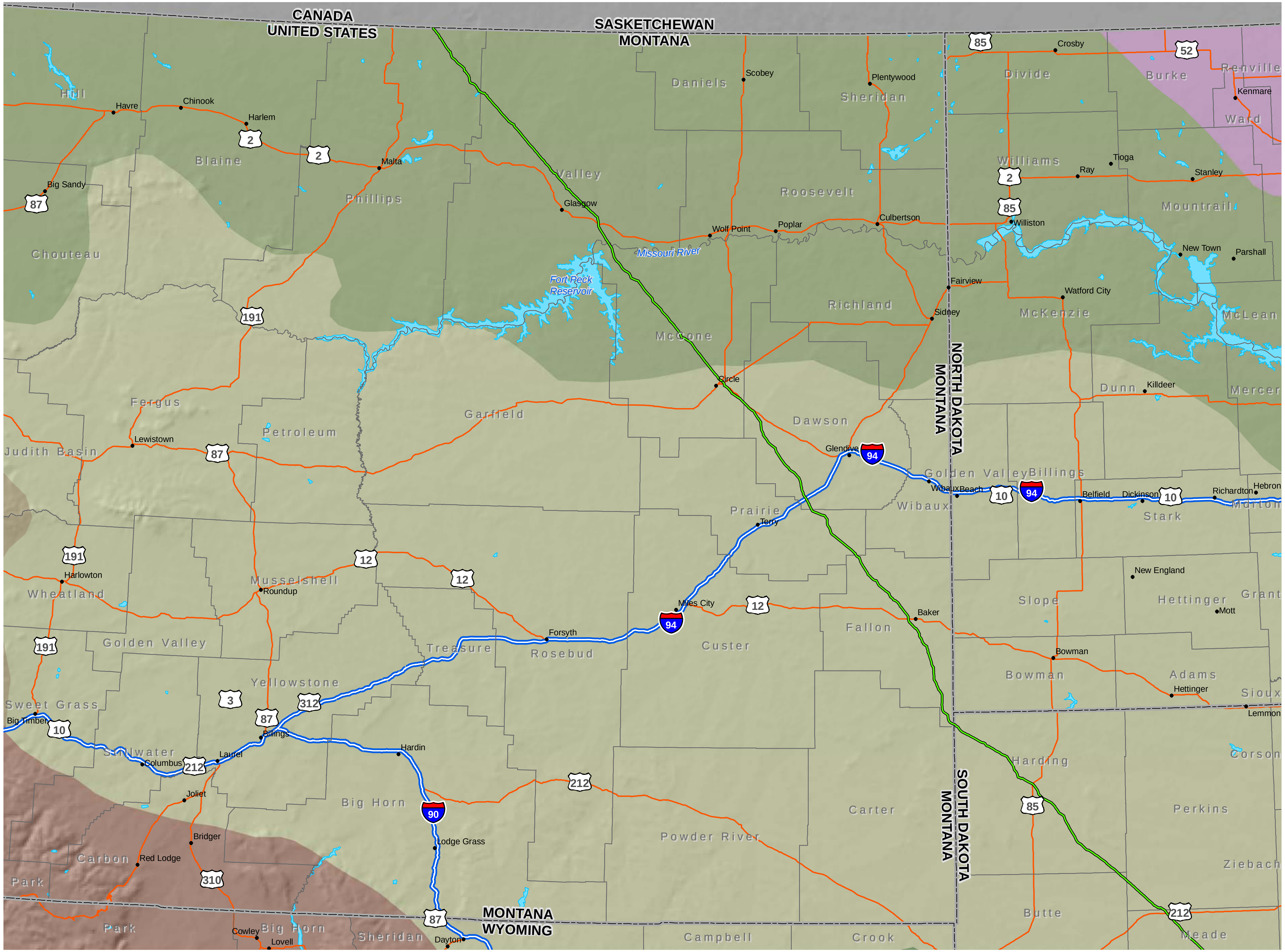

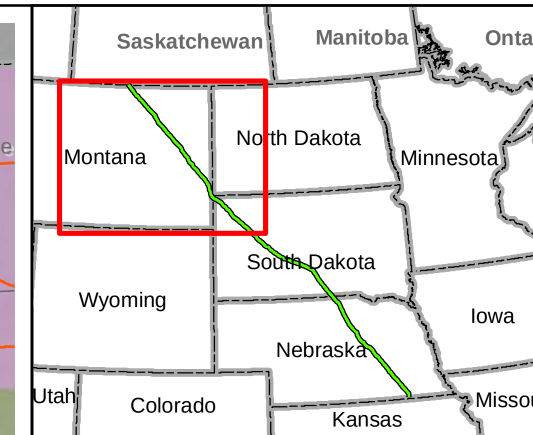

Legend

- Towns/Cities
- Steele City Segment

Major Highways

- Interstate Highway
- US Highway
- Lake/Reservoir

Physiographic Sections

Great Plains Province

- Black Hills
- Missouri Plateau, Glaciated
- Missouri Plateau, Unglaciated

Rocky Mountain System Division

- Northern Rocky Mountains
- Middle Rocky Mountains

Central Lowlands Province

- Western Lake

0 15 30 60 Miles
0 15 30 60 Kilometers
1:2,000,000

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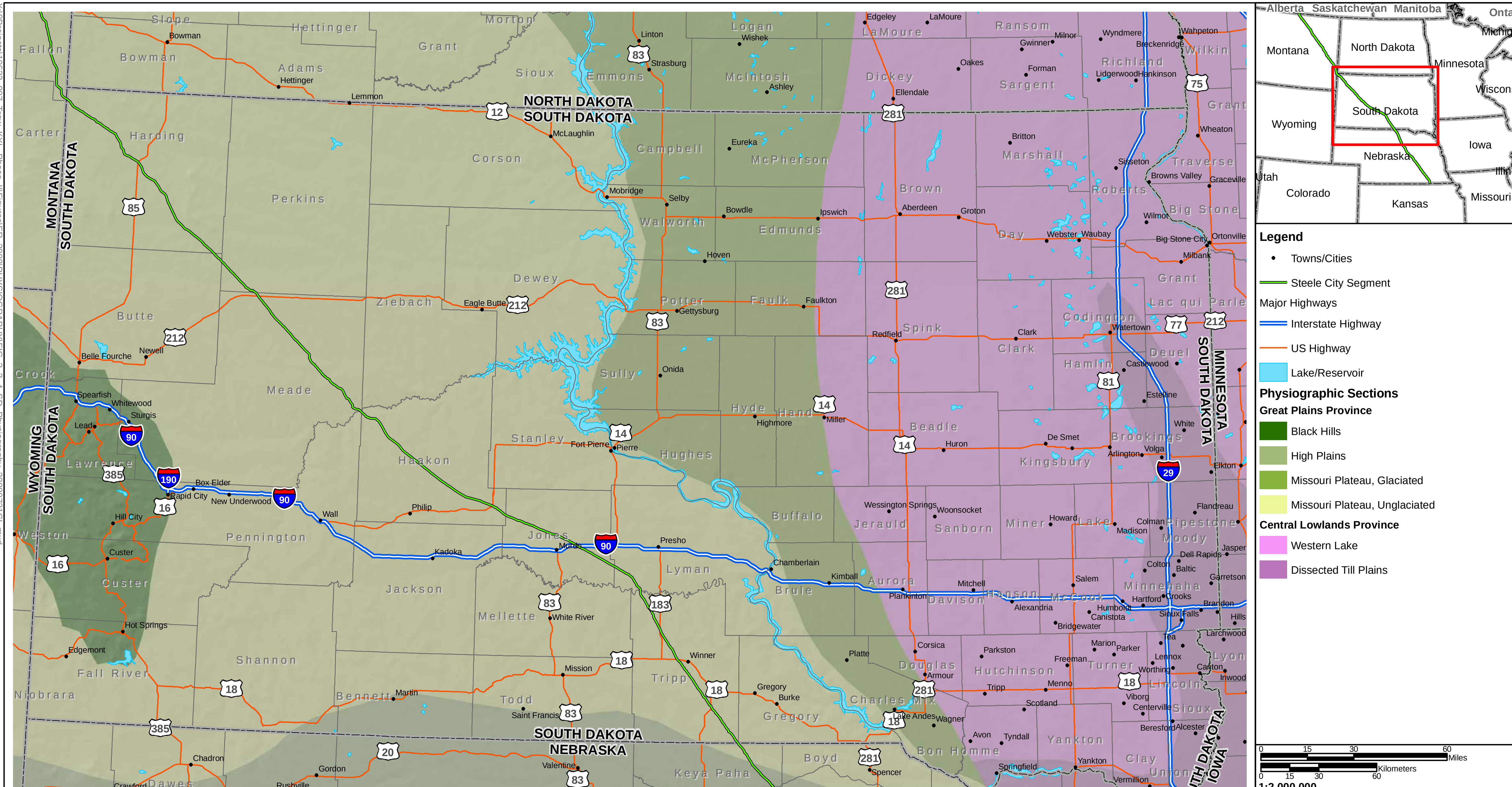
TransCanada
Keystone XL Project

Figure 3.3-1

Physiographic Regions of Eastern Montana



TransCanada
Keystone XL Project

Figure 3.3-2

Physiographic Regions of South Dakota

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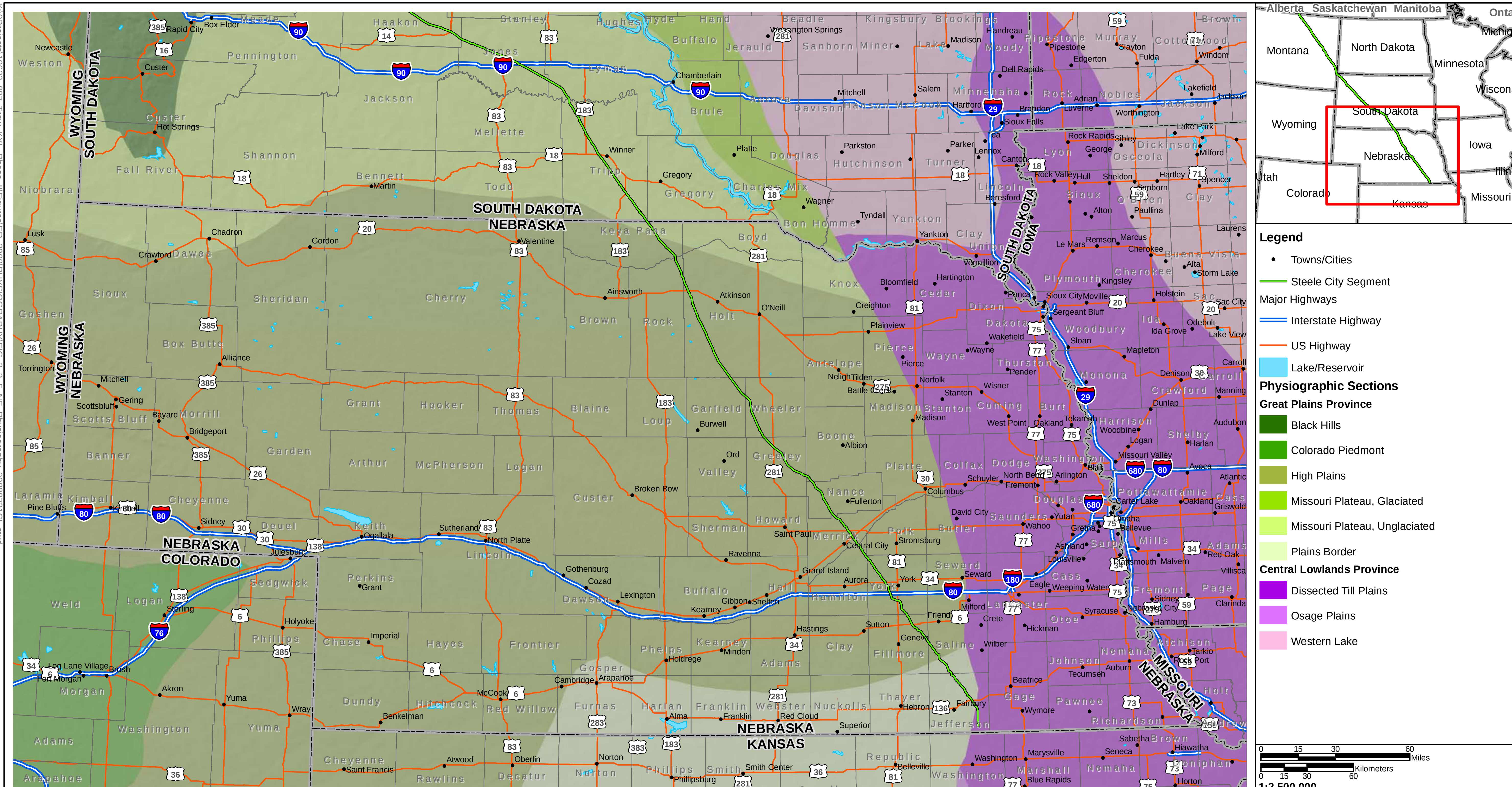

TransCanada
Keystone XL Project

Figure 3.3-3

Physiographic Regions of Nebraska

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3.3.5 Oklahoma

3.3.5.2 Geology

In Oklahoma, the Project will consist of new pipeline and associated facilities in the Gulf Coast Segment from Cushing south to the Texas border.

South of Cushing the route will cross Pennsylvanian rock, which covers approximately 25 percent of the surface of the state. The Pennsylvanian rocks of southeast Oklahoma reflect the fluctuating sea-level conditions as most of the rock sequences exhibit alternating beds of sandstone, shale, and sometimes limestone that formed under marine and non-marine conditions. During the Late Cretaceous time, formation of the Rocky Mountains caused general uplift of the land in western North American. This caused the large inland sea that covered much of the state to push further south and west into Texas and New Mexico and non-marine river and flood plain sands, silts, and clays were deposited into far southeast Oklahoma (Johnson 1996).

3.3.5.3 Mineral Resources

Oil and natural gas are important mineral resources present in the area of the Gulf Coast Segment in Oklahoma. There are numerous oil and gas fields in the vicinity (Boyd 2002a). From the Cushing Pump Station south to the Texas state line, the route passes 752 oil and gas wells within 1320 feet of the proposed pipeline (see Appendix J). The oil fields primarily produce from Mississippian, middle and upper Pennsylvanian and Permian reservoirs (Boyd 2002b). Other mineral resources in the counties along the route include sand, gravel, and crushed stone (Johnson 1998; USGS 2004h).

3.3.5.4 Paleontological Resources

In Oklahoma, the Gulf Coast Segment of the pipeline traverses, from north to south, rock formations of the Permian, Carboniferous, and Cretaceous geological periods (Figure 3.3-4). The Permian period (299 million years ago [mya] to 251 mya) and the Carboniferous period (359 mya to 299 mya) are subdivisions of the Paleozoic era (542 to 251 mya). The Cretaceous period (145.5 mya to 65.5 mya) is the latest division of the Mesozoic era (251 mya to 65.5 mya). The Mesozoic era is colloquially referred to as the “Age of Reptiles” in reference to dinosaurs that first inhabited the Earth at the beginning of the Mesozoic and became extinct at the end of this era. The following discussion is a detailed description of the Paleontological periods and associated resources that could exist and could be impacted.

<u>Permian Period – 299 mya to 251 mya</u>

A shallow sea covered much of Oklahoma during the Permian period. As the sea retreated westward at the close of the period, dense layers of gypsum and salt were deposited. A very short portion of the Gulf Coast Segment of the pipeline in Payne and Lincoln Counties includes areas for which Permian period formations were mapped. Paleontological resources potentially present in Permian period formations in Payne and Lincoln Counties are listed in Table 3.3-7. Although rare fossils of insects were collected from Permian rock formations elsewhere the world, the Permian period is best known for its vertebrate fossils (Kazlev 2002b), namely amphibians and reptiles. In fact, some of the best-preserved arthropod specimens came from the Permian “red beds” of Oklahoma and Texas. However, the Permian formations in Payne and Lincoln Counties include invertebrate fossils. Permian period rock formations in Seminole County will not be crossed by the proposed Project; Permian period formations are not known to occur in the other six counties to be crossed by the proposed Project.

Table 3.3-7 Potential Permian Period Paleontological Resources – Gulf Coast Segment, Oklahoma

Counties	Formation	Paleontological Resources	Information Source
Payne	Brownville Limestone	crinoids, coronates, hemistreptocrinoids	Moore 1939, Bassler and Moodey 1943, Moore and Laudon 1944, Knapp 1969
Payne and Lincoln	Elmont Limestone	crinoids, fusilinids, brachiopods	Moore 1939, Bassler and Moodey 1943, Moore and Laudon 1944, Knapp 1969
Payne and Lincoln	Grayhorse Limestone	crinoids, fusilinids, brachiopods	Moore 1939, Bassler and Moodey 1943, Moore and Laudon 1944, Knapp 1969,
Lincoln	Ada Group	crinoids, brachiopods, corals	Kissel and Lehman 2002
Lincoln	Vanoss Group	crinoids, brachiopods, corals	Blatt and Caprara 1985

<u>Carboniferous period – 359 mya to 299 mya</u>

The Carboniferous period in Oklahoma was characterized by vast swampy deltas deposited by rivers under warm and moist tropical conditions. Dense vegetation fostered by the swampy environment would become the coal seams prevalent in eastern Oklahoma today. Many types of insects, spiders, and other types of arthropods inhabited the great forests of the Carboniferous period (Kazlev 2002c). Periodically a shallow sea encroached into eastern Oklahoma leaving behind crinoid, coral, brachiopod, and other marine fossils, including an amazing diversity of sharks and other fish, amphibians, and reptiles (Kazlev 2002c). The portion of the Gulf Coast Segment of the pipeline that traverses Creek, Okfuskee, Seminole, Hughes, Coal, and the northern half of Atoka Counties, will cross areas for which rock formations of the Carboniferous period have been mapped. Paleontological resources potentially present in Carboniferous period formations in these counties are listed in Table 3.3-8. Carboniferous period rock formations have not been mapped in the south half of Atoka County nor any part of Bryan County.

Table 3.3-8 Potential Carboniferous Period Paleontological Resources – Gulf Coast Segment, Oklahoma

Counties	Formation	Paleontological Resources	Information Source
Creek and Okfuskee	Ada Group	crinoids, brachiopods, corals	Kissel and Lehman 2002
Creek, Okfuskee, Seminole	Americus Limestone	fusulinids, brachiopods	Moore et al. 1952
Okfuskee	Barnsdale Formation	crinoids	Strimple 1975
Seminole, Hughes	Coffeyville Formation and Checkerboard Limestone	varied flora	Peppers 1996
Seminole	Nellie Bly Formation and Hogshooter Limestone	cephalopods and ammonoids	Ramsbottom and Saunders 1985

Table 3.3-8 Potential Carboniferous Period Paleontological Resources – Gulf Coast Segment, Oklahoma

Counties	Formation	Paleontological Resources	Information Source
Seminole, Hughes	Seminole Formation	crinoids	Hess et al 1999
Hughes	Holdenville Shale	nautiloids	Kroger and Mapes 2004
Hughes	Wetumka Formation	shark teeth, nautiloids	Stovall 1945
Coal	Atoka Formation	fusulinids	Thompson 1935
Coal	Boggy Formation	rare plant fragmental fossils, shark teeth	Taff 1899
Coal	Hartstone Sandstone	rare plant fragmental fossils	Taff 1899
Coal	McAlester Formation	plants, rare invertebrate fossils	Taff 1899
Coal	Savanna Formation	plants, rare invertebrate fossils	Taff 1899

<u>Cretaceous period – 145.5 mya to 65.5 mya</u>

Across North America, the Cretaceous period was a time of tectonic upheaval that saw the upward thrust of the Rocky Mountains and a continual fluctuation of sea levels that left behind a geologic record of non-marine and marine environments. By the Late Cretaceous epoch, angiosperm plants had become the dominant terrestrial macro-organisms (Kazlev 2002d). Also by this time, a sharp increase occurred in the diversity and biomass of marine organisms with mineralized skeletons (Kazlev 2002d). Rock formations of the Cretaceous period yield a diverse fossil record that also includes non-avian dinosaurs, which became extinct at the close of the Cretaceous period (Pierson 2008, Newman, Scotchmoor, and Reiboldt 2006). The portion of the Gulf Coast Segment of the pipeline that traverses the south half of Atoka County and all of Bryan County will cross rock formations of the Cretaceous period. Paleontological resources potentially present in Cretaceous period formations in Atoka and Bryan Counties are listed in Table 3.3-9.

Table 3.3-9 Potential Cretaceous Period Paleontological Resources – Gulf Coast Segment, Oklahoma

Counties	Formation	Paleontological Resources	Information Source
Atoka	Antlers Sand	dinosaurs	Wedel and Cifelli 2005
Atoka	Atoka Formation	fusulinids	Thompson 1935
Atoka	Goodland Lime and Walnut Clay	ostracods	Alexander 1933
Atoka	Hartshorne Sandstone	rare plant fragmental fossils	Taff 1899
Atoka	McAlester Formation	plants, rare invertebrate fossils	Taff 1899
Bryan	Caddo Formation	conodonts, oysters	Jocobi 2004
Bryan	Grayson Marl and Bennington Limestone	foraminifera, ostracods	Glaessner 1955

Table 3.3-9 Potential Cretaceous Period Paleontological Resources – Gulf Coast Segment, Oklahoma

Counties	Formation	Paleontological Resources	Information Source
Bryan	Lewisville Member	fish, reptiles, invertebrates	Stephenson 1952
Bryan	Red Branch Member	fish, reptiles, invertebrates	Stephenson 1952
Bryan	Woodbine Formation	fish, reptiles, invertebrates	Stephenson 1952

The Tertiary period (65.5 mya to 2 mya) includes, in descending chronological order, the Paleocene, Eocene, Oligocene, Miocene, and Pliocene epochs. The first large mammals and primitive primates appeared on Earth during the Paleocene epoch, and hominids (austrolopithecines) evolved on Earth during the Pliocene epoch.

The Quaternary period (2 mya to present), colloquially known as the "Age of Humans," includes the Pleistocene and Holocene epochs (in descending chronological order). The last Ice Age comprises the Pleistocene epoch (2 mya to 11,000 years ago); the world's megafauna became extinct during this epoch (e.g., mastodons that populated unglaciated portions of North America). During the Holocene epoch (11,000 years ago to present), human populations diversified and created cultural resources, some of which are discussed in this report in Section 3.9 of this report.

3.3.5.5 Geological Hazards

Seismic

Oklahoma is located within the stable interior of the United States and, even though the state has had almost no significant tectonic activity since Pennsylvanian and Permian time, approximately 50 minor earthquakes occur each year. There are at least four principal seismic areas in the state based on a consistent pattern of earthquake recurrence: north central, western, south central, and the southeast. (Luza and Johnson 2005).

The general area of earthquake activity in southeast Oklahoma occurs north of the Ouachita Mountains in the Arkoma Basin. Approximately 90% of all earthquakes in the Arkoma Basin were not felt by humans, but registered by instruments. The earthquake magnitudes ranged from 1.8 to 2.5, and the focal depths were generally shallow (< 3 miles) (Luza and Johnson 2005).

The USGS ground motion hazard mapping indicated that potential ground motion hazard in the proposed Project area is low. The hazard map estimates peak ground acceleration expressed as a percentage of the acceleration of gravity with a 8-10 percent probability of exceedance in 50 years (USGS 2008a).

Landslides

Most of the landslides that occur in Oklahoma occur in the eastern one-third of the state because of the wetter climate and the steeper slopes of the more mountainous terrain. In this part of the state, thick shale formations (Pennsylvanian) weather quickly and produce large amounts of clayey colluvium. This material usually occurs as a veneer, one to several meters thick, which masks the underlying bedrock on a slope. Rotational slump is the most common type of landslide in Oklahoma. A rotational slump is characterized by the movement of a mass of weak rock or sediment as a block unit along a curved slip plane. Generally, the threat of landslides is high where natural slopes exceed a gradient of 2:1 (Luza and Johnson 2005).

Subsidence

Karst features, including fissures, tubes, and caves do occur in gently dipping to flat-lying carbonate rock in southeastern Oklahoma. Generally these features are less that 1,000 feet long and 50 feet or less in vertical

extent. No ground subsidence hazards have been identified in the vicinity of the proposed route (National Atlas 2008).

<u>Flooding</u>

In general, seasonal flooding hazards exist where the proposed pipeline route will cross rivers and streams, and flash flooding hazards exist where the pipeline will cross localized drainages. The proposed pipeline route will cross 58 perennial streams 122 intermittent streams, and 77 ephemeral drainages, all of whch are locations where seasonal or flash flooding could occur. The stream and drainage crossings are listed in Appendix E. No pump stations are located within the floodplain.

3.3.6 Texas - Gulf Coast Segment

3.3.6.2 Geology

The Gulf Coast Segment located in Texas will be entirely within the Gulf Coastal Plains physiographic region. Within the Gulf Coastal Plains, three subprovinces will be crossed: the Coastal Prairies, the Interior Coastal Plains, and the Blackland Prairies. These physiographic regions of east Texas and the Gulf Coast were developed during the early Mesozoic era (Late Triassic epoch). In the Triassic era, an ocean basin began to develop due to a series of discontinuous rift (continental extension) basins. During the early Cretaceous era, shallow Mesozoic seas (the Gulf) extended inland, covering much of the state of Texas (Hentz 2008). The shallow seas were filled with calcareous-shelled organisms, and thick deposits of limestone were laid down (Spearing 1991). Regional uplift of the western United States in the late Cretaceous elevated the central Texas area, as the Gulf continued to deepen, causing sandy and muddy sediments to pour southeastward into east Texas and the Gulf (Hentz 2008).

The Blackland Prairie area of the innermost Gulf Coastal Plains in northeast Texas is characterized by black, sandy, calcareous soil derived from underlying beds of glauconitic sands and clays. These lands represent the surface residuum of the uppermost beds of the Cretaceous formations (Hill 1901). The Blacklands have a gentle undulating surface with very few outcroppings (Wermund 2008). The Interior Coastal Plains comprise alternating belts of resistant uncemented sands among weaker shales that erode into long, sandy ridges. This area is of low relief, except for locations where river drainages created low hills and valleys as they carve into the soft Eocene sandstone bedrock (Spearing 1991). The sandy early Tertiary rocks that lie at the surface of the eastern Interior Coastal Plains form an ideal substrate for the piney woods that are predominate in this area. Salt domes exist in the eastern part of this region where down-to-the coast fault systems exist. The Coastal Prairies, which span all of the immediate Gulf Coast of Texas, is underlain with young deltaic sands, silts, and clays that erode to nearly flat grasslands with almost imperceptible slopes to the southeast (Wermund 2008). Minor, steeper slopes, from 1 foot to as much as 9 feet high, result from subsidence of deltaic sediments along faults. The surface sediments in this portion of the Project area consist of sands, clays, and mud (Wermund 2008).

3.3.6.3 Mineral Resources

Texas is among the nation's leading producers of crushed stone, which is produced across the state. Lignite constitutes 97 percent of the near-surface coal resources in Texas (Garner 2008). The most significant bituminous resources are in the northcentral and southern parts of the state (OSMRE 2008). From the Oklahoma state line south to where the Gulf Coast Segment terminates, the route passes within 1,320 feet of 389 oil and gas wells (see Appendix J). Other major mineral resources extracted in the vicinity of the proposed route include clay, iron, peat and sands (Garner 2008).

3.3.6.4 Paleontological Resources

In Texas, the Gulf Coast Segment of the pipeline traverses, from north to south, rock formations of the Cretaceous, Tertiary, and Quaternary geological periods (Figure 3.3-4). The Cretaceous period is the latest division of the Mesozoic era (251 mya to 65.5 mya) while the Tertiary and Quaternary periods comprise the Cenozoic era (65.5 mya to present). The Cenozoic is colloquially referred to as the "Age of Mammals" since these vertebrates diversified and continues to become numerous.

The Tertiary period (65.5 mya to 2 mya) includes, in descending chronological order, the Paleocene, Eocene, Oligocene, Miocene, and Pliocene epochs. The first large mammals and primitive primates appeared on Earth during the Paleocene epoch, and hominids (austrolopithecines) evolved during the Pliocene epoch.

The Quaternary period (2 mya to present), colloquially known as the "Age of Humans," includes the Pleistocene and Holocene epochs in descending chronological order. The last ice age comprises the Pleistocene epoch (2 mya to ~ 11,000 years ago); the world's megafauna became extinct during this epoch (e.g., mastodons that populated unglaciated portions of North America). The following is a deailed discussion of these periods and the potential resources that may be encountered and impacted.

<u>Cretaceous period – 145.5 mya to 65.5 mya</u>

The Cretaceous period in Texas can be described in the same manner as the Cretaceous period in Oklahoma (Section 3.3.4.3). Cretaceous period rock formations lie within the portion of the Gulf Coast Segment of the pipeline that traverses Fannin, Lamar, and Delta Counties. Paleontological resources potentially present are listed in Table 3.3-10. Cretaceous period formations are not known to occur in the other 13 counties crossed by the Gulf Coast Segment.

Table 3.3-10 Potential Cretaceous Period Paleontological Resources – Gulf Coast Segment, Texas

Counties	Formation	Paleontological Resources	Information Source
Fannin, Lamar	Eagle Ford Formation	ammonites, pelecypods, fish teeth	Scott 1940
Lamar	Blossom Sand	ammonites	Kennedy et al 2001
Lamar	Bonham Formation	annelids	Welton and Farish 1993
Lamar	Brownstone Marl	bivalves, some cephalopods, echinoderms, fish material, annelids	Hill 1888
Lamar	Gober Chalk	shark teeth, ammonites	Ham and Shimada 2004
Lamar	Ozan Formation	bivalves, cephalopods, gastropods, echinoderms, corals, crustaceans, fish material, annelids	Dane 1926
Lamar	Roxton Limestone	ammonites	Cobban and Kennedy 1992
Lamar	Wolfe City Formation	ammonites, crustaceans, polycheates	Cobban and Kennedy 1993
Delta	Marlbrook Marl	oysters, reptiles	Hill 1888

Table 3.3-10 Potential Cretaceous Period Paleontological Resources – Gulf Coast Segment, Texas

Counties	Formation	Paleontological Resources	Information Source
Delta	Navarro Group	porifera, vermes, echinoderms, mollusks, corals, crustaceans	Stephenson 1941
Delta	Neylandville Formation	porifera, vermes, echinoderms, mollusks, corals, crustaceans	Stephenson 1941
Delta	Pecan Gap Chalk	foraminifera, mollusks, echinoderms, sharks	Frizzell 1950

Tertiary period – 65.5 mya to 2 mya

The Tertiary period of the Cenozoic era saw a massive movement of clastic sediment washing southeast from the rising Rocky Mountains toward the Gulf of Mexico. The fossil record of the Tertiary period includes a vast vertebrate collection including many fossil mammals (Pierson 2008, Newman, Scotchmoor, and Reiboldt 2006). The portion of the Gulf Coast Segment in Hopkins, Franklin, Wood, Upshur, Smith, Cherokee, Rusk, Nacogdoches, Angelina, and Polk Counties traverses Tertiary period rock formations. Paleontological resources potentially present are listed in Table 3.3-11. Tertiary period formations are not known to occur in the other six counties to be crossed by the Gulf Coast Segment.

Table 3.3-11 Potential Tertiary Period Paleontological Resources – Gulf Coast Segment, Texas

Counties	Formation	Paleontological Resources	Information Source
Hopkins	Midway Group	bivalves, gastropods, foraminifera, ostracods with bryozoa, brachiopods, echinoids, crabs, fish, crocodile teeth	Harris 1894, Harris 1896
Hopkins	Navarro Group	porifera, vermes, echinoderms, mollusks, corals, crustaceans	Stephenson 1941
Hopkins, Franklin	Wilcox Group	abundant plant fossils	Bureau of Economic Geology 1986
Franklin, Smith, Rusk, Nacogdoches	Reklaw Formation	mollusks, corals, crustaceans, echinoids	Zachos and Molineux 2003
Wood, Upshur, Cherokee, Rusk, Nacogdoches	Weches Formation	mollusks, corals, crustaceans, echinoids	Zachos and Molineux 2003
Cherokee, Angelina	Cook Mountain Formation	mollusks, corals, crustaceans, echinoids	Zachos and Molineux 2003
Angelina	Caddell Formation	mollusks, corals, crustaceans, echinoids	Zachos and Molineux 2003
Angelina	Yegua Formation	marine megafossils, foraminifera	Layman 1987
Polk	Catahoula Formation	abundant fossil wood, land	Albright 1998

Table 3.3-11 Potential Tertiary Period Paleontological Resources – Gulf Coast Segment, Texas

Counties	Formation	Paleontological Resources	Information Source
		mammals	
Polk	Fleming Formation	microvertebrates	Schiebout and Ting in press
Polk	Manning Formation	abundant fossil wood	Kaiser et. al. 1980
Polk	Wellborn Formation	abundant fossil wood, imprints of marine megafossils	Bureau of Economic Geology 1986
Polk	Whitsett Formation	abundant fossil wood	Bureau of Economic Geology 1986

Quaternary period – 2 mya to present

A wide band of Quaternary period deposits exists along the coastline of Texas. The Quaternary period is characterized by repeated glaciations, the last of which ended approximately 11,000 years ago. Massive runoff from melting glaciers contributed to the formation of several major watersheds in the Project vicinity in Texas. Fossils found in Quaternary deposits include bones of bison, mammoths, and mastodons (Pierson 2008, Newman, Scotchmoor, and Reiboldt 2006). The portion of the Gulf Coast Segment of the pipeline in Liberty, Hardin, and Jefferson Counties traverses Quaternary period formations. Paleontological resources potentially present in are listed in Table 3.3-12. Quaternary period rock formations have not been mapped for the other 13 counties to be crossed by the Project.

Table 3.3-12 Potential Quaternary Period Paleontological Resources – Gulf Coast Segment, Texas

Counties	Formation	Paleontological Resources	Information Source
Liberty, Jefferson	Beaumont Formation	land mammals, birds, reptiles, Pleistocene megafauna	Baskin and Cornish 1989

3.3.6.5 Geologic Hazards

Seismic Hazards

The gulf-margin normal faults border the northern Gulf of Mexico in east and south Texas. The gulf-margin normal faults are categorized in Class B because they exist in sediments and poorly lithified rocks, which are materials that may not be unable to endure the stresses required for the propagation of significant seismic ruptures that could cause damaging ground motions. In east Texas, Triassic-Jurassic rifting and sedimentation, including deposition of the Louann Salt, led to Mesozoic growth faulting and salt tectonism. For the Coastal Prairies normal faults area, after formation of the early Cretaceous shelf edge, late Cretaceous and especially Cenozoic clastic sediments prograded southward, and their load led to abundant Cenozoic and continuing growth faulting and salt tectonism. Epicenter maps show only sparse, low-magnitude seismicity within the belt of normal faults. Probabilities for exceedance for peak ground acceleration for the proposed Project area are low (USGS 2008b). East Texas and the Texas Gulf Coast, including the proposed Project area, are located in Seismic Zone 0 and 1 of the Uniform Building Code's Seismic Risk Map (USACE 1995). Due to the low risk of seismic activity, seismic hazards are not considered relevant to the Project. Surface faults have been mapped in the Project area, particularly related to the numerous salt domes located in east

Texas and in the upper Coastal Prairie. However, there is little evidence of movement along these faults, and the region has very low seismic activity (Crone and Wheeler 2000). Therefore, surface faults pose very little risk to the Project.

Landslide

Based on the Natural Resource Conservation Service (NRCS) online soil survey, all the soils encountered within the proposed Project area are between one percent and six percent slope (USDA 2008). These minimal slopes generally are not conducive to landslides or slope movement.

Subsidence

Karst features, including fissures, tubes, and caves do occur in gently dipping to flat-lying carbonate rock in east Texas. Generally these features are less that 1,000 feet long and 50 feet or less in vertical extent. No ground subsidence hazards have been identified in the vicinity of the proposed route (National Atlas 2008).

Flooding

In general, seasonal flooding hazards exist where the proposed pipeline route will cross rivers and streams, and flash flooding hazards exist where the pipeline will cross localized drainages. The proposed pipeline route will cross 93 perennial streams, 124 intermittent streams, and 123 ephemeral drainages, all of which are locations where seasonal or flash flooding could occur. The stream and drainage crossings are listed in Appendix E. The Gulf Coast Segment has two pump stations currently located in identified flood zones.

3.3.7 Texas - Houston Lateral

3.3.7.2 Geology

The Houston Lateral will be located entirely in the Coastal Prairie subprovince of the Coastal Plains physiographic region. The area is underlain with young deltaic sands, silts, and clays that erode to nearly flat grasslands that form almost imperceptible slopes to the southeast (Wermund 2008). These sediments were deposited under a fluvial-deltaic to shallow-marine environments during the Miocene to the Pleistocene periods. Minor, steeper slopes, from 1 foot to as much as 9 feet high, result from subsidence of deltaic sediments along faults. The surface sediments in this portion of the Project area consist of sands, clays, and mud (Table 3.3-13). The soils correspond to the Beaumont Formation (late Pleistocene) (Wermund 2008). The Trinity and San Jacinto Rivers dissect the Coastal Prairies in the Project area and flow nearly perpendicular to the Gulf of Mexico shoreline. Between the valleys of the major rivers crossing the coastal plains, differential erosion of the softer and harder beds led to the formation of parallel low ridges and escarpments (Chowdhury 2006).

3.3.7.3 Mineral Resources

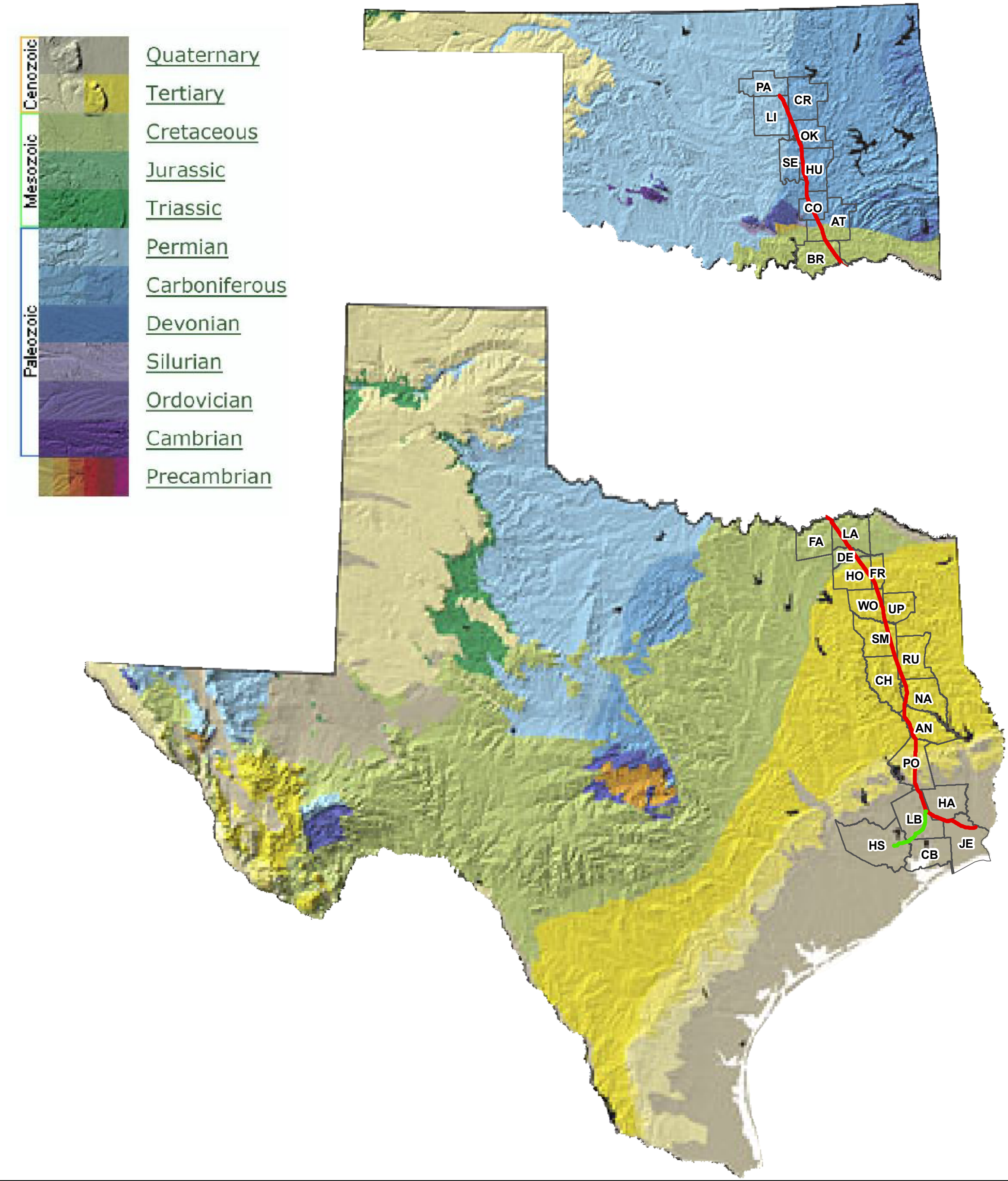
Oil and natural gas are important mineral resources along the Houston Lateral. The Houston Lateral will pass 1,051 oil and gas wells within 1,320 feet of the pipeline. Texas is one of the leading producers of clays in the United States. Most non-ceramic products are produced from bentonites, found primarily in the Coastal Plains. Sand and gravel are important mineral resources present along the Lateral. Sands suitable for industrial use occur in the Tertiary deposits of the Texas Coastal Plain including Harris County. Gravel deposits of commercial value are located in Liberty County, adjacent to the major rivers that flow across Texas (Garner 2008).

3.3.7.3 Paleontological Resources

The Houston Lateral is proposed through Liberty, Chambers, and Harris Counties and will traverse rock formations of the Quaternary period. Characteristics and fossil resources of the Quaternary period are presented in Section 3.3.5.3. Paleontological resources potentially present are listed in Table 3.3-13. Quaternary period rock formations have not been mapped for the other 13 counties to be crossed by the Project.

Table 3.3-13 Potential Quaternary Period Paleontological Resources – Houston Lateral

Counties	Formation	Paleontological Resources	Information Source
Liberty, Chambers, Harris	Beaumont Formation	land mammals, birds, reptiles,	Kurten and Anderson 1980, Martin and Klein 1984



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N
W E
S

0 60 120 240 Miles

0 100 200 400 Kilometers

Source: www.paleoportal.org

Legend

County Boundaries

Keystone XL Project

Gulf Coast Segment

Houston Lateral

TransCanada *In business to deliver*

ConocoPhillips

Keystone XL Project

Figure 3.3-4

Paleontology and Geology

3.2.6.4 Geologic Hazards

Seismic Hazards

There are several hundred faults in the Gulf Coast region. These are primarily gulf margin listric normal faults which developed in the thick sedimentary sequences over a rifted margin. The faults exist in sediments and poorly lithified rocks. Movement along these faults in modern times is primarily the result of petroleum production and groundwater pumping. Epicenter maps show only sparse, low-magnitude seismicity within the belt of normal faults (Crone and Wheeler 2000).

Although there are numerous Quaternary surface faults in the Gulf Coast region, earthquakes with epicenters in southeast Texas are rare and of low magnitude (Crone and Wheeler 2000). Probabilities for exceedance for peak ground acceleration for the proposed Project area are low (USGS 2008b). The Texas Gulf Coast, including the proposed Project area, is located in Seismic Zone 0 of the Uniform Building Code's Seismic Risk Map (USACE 1995). Due to the low risk of seismic activity, seismic hazards are not considered relevant to the Project.

Several surface faults were mapped in the Freeport area, particularly related to the Stratton Ridge Salt Dome and the Bryan Mound Salt Dome. However, there is little evidence of movement along these faults, and the region has very low seismic activity (Crone and Wheeler 2000). Therefore, surface faults pose very little risk to the Project.

Subsidence

Significant land surface subsidence in the Houston-Galveston region occurs as the result of groundwater extraction and the subsequent compaction of the subsurface clays (Gabrysch 1984). In the Texas City area, the amount of land undergoing at least one foot of subsidence has grown from about 140 mi^2 in the 1940s to more than 3,600 mi^2 in the 1980s (Gibeaut 2000). Faulting and subsidence in the Houston area declined following the reduction of groundwater pumping in the area (Holzer and Gabrysch 1982).

Subsidence

Karst features, including fissures, tubes, and caves do occur in gently dipping to flat-lying carbonate rock in southeast Texas. Generally these features are less that 1,000 feet long and 50 feet or less in vertical extent. No ground subsidence hazards have been identified in the vicinity of the proposed route (National Atlas 2008).

Flooding

In general, seasonal flooding hazards exist where the proposed pipeline route will cross rivers and streams, and flash flooding hazards exist where the pipeline will cross localized drainages. The proposed pipeline route will cross 93 perennial streams, 124 intermittent streams, and 123 ephemeral drainages (Gulf Coast Segment and Houston Lateral combined), all of which are locations where seasonal or flash flooding could occur. The stream and drainage crossings are listed in Appendix E. The Houston Lateral has no pump stations currently located in identified flood zones.

3.4 Soils

The Project route will be located within six Land Resource Regions of soil resources. Generally, from north to south, these include the following (USDA 2006):

- Northern Great Plains Spring Wheat Region;

- Western Great Plains Range and Irrigated Region;
- Central Great Plains Winter Wheat and Range Region;
- Southwestern Prairies Cotton and Forage Region;
- South Atlantic and Gulf Slope Cash Crops, Forest, and Livestock Region; and
- Atlantic and Gulf Coast Lowland Forest and Crop Region.

The Northern Great Plains Spring Wheat Region is located in the northernmost portion of the route in Montana and South Dakota. Much of this region has been topographically smoothed by continental glaciation and is blanketed by undulating till and level to gently rolling lacustrine deposits. The soils typically have thick, dark topsoils with mixed or smectitic mineralogy. Ustolls occur on uplands; Aquolls occur in low wet areas and along streams. Some of the Ustolls have a high content of sodium, and some of the Aquolls have a high content of sodium and lime. Orthents occur on the steeper slopes. The soils in the region predominantly have a frigid soil temperature regime, and ustic or aquic soil moisture regime.

The Western Great Plains Range and Irrigated Region includes portions of Montana, South Dakota, and northern Nebraska. This region is an elevated piedmont plain dissected by numerous rivers flowing to the east. Slopes generally are gently rolling or rolling. Flat-topped, steep-sided buttes and badlands also occur in this region. The soils are varied and range from very deep organic soils to shallow soils with thin topsoil horizons. Most have mixed or smectitic mineralogy, but some have carbonatic mineralogy. Most of the soils in the region have a mesic or frigid soil temperature regime and an ustic or aridic soil moisture regime.

The Central Great Plains Winter Wheat and Range Regions include portions of Nebraska, Kansas, and Oklahoma. This region is a nearly level to gently rolling fluvial plain. The soils in this region are similar to those in the Western Great Plains Range and Irrigated Region, with generally warmer temperatures. Mineralogy is dominantly mixed but is smectitic or carbonatic in some soils.

The Southwestern Prairies Cotton and Forage Regions include portions of Oklahoma and Texas. The northern and western portions of this region consist of gently rolling to hilly uplands dissected by numerous streams. The rest of the region is a nearly level to gently sloping, dissected plain. The Arbuckle and Wichita Mountains are in the northern part of the region. The soils are similar to the southern portion of the Central Great Plains Winter Wheat and Range Region. Mineralogy is dominantly mixed or smectitic, but it is siliceous in the Cross Timbers area and carbonatic on the Edwards Plateau, the central part of the region.

The South Atlantic and Gulf Slope Cash Crops, Forest, and Livestock Regions include a small portion of southern Oklahoma and eastern Texas. This region consists of relatively smooth Atlantic and Gulf Coast marine terraces and hilly piedmont areas. The soils are highly varied in this region. They have a similar temperature regime as the Southwestern Prairies Cotton and Forage Region. The soils east of the Mississippi River formed in thick deposits of loess. The soils in the central part of the region formed in clayey deposits. The soils in the northwest corner of the region formed on the ridgetops and bottomland.

The Atlantic and Gulf Coast Lowland Forest and Crop Regions include a small portion of southeast Texas along the Gulf Coast. This is a region of coastal lowlands, coastal plains, and the Mississippi River Delta. The region is mostly level to gently sloping and has low relief. The soils in this region are varied, and formed in alluvium on flood plains, in depressions, and on terraces. Sandy soils are common as are indurated soils. These soils have a siliceous, mixed, or smectitic mineralogy.

3.4.1 Summary Soil Characteristics

This section includes a description of the soil characteristics for the Project. The soil baseline characterization for the proposed Project is based on Soil Survey Geographic (SSURGO) database review and analyses. SSURGO is the most detailed level of soil mapping available by the Natural Resources Conservation Service

(NRCS) (USDA 2007). This investigation focused on soil characteristics or limitations of particular interest to the proposed pipeline construction. The results of the SSURGO data assessment are shown in Tables 3.4-1 and 3.4-2. Please refer to Appendix K for a summary of soil map units crossed by the ROW for each county. Hydric soils crossed by the Project are described in further detail in the wetland reports.

Sensitive soils including prime farmland, hydric, highly erodible, low reclamation potential, droughty, and other important soil characteristics are described in further detail below.

Prime farmland soils are defined by the USDA as those that are best suited for food, feed, forage, fiber, and oilseed crops. These soils have properties that favor the economic production of sustained high yields of crops (USDA, 2006b). Prime farmland is represented by many soil associations and series and does not need to be actively cultivated to be classified as prime farmland. Any undeveloped land with high crop production potential can be included in this classification.

A hydric soil is defined by the USDA as soil that formed under conditions of saturation, flooding, or ponding for a long enough period during the growing season to develop anaerobic conditions in the upper part. These soils, under natural conditions, are either saturated or inundated for a sufficient period during the growing season to support the growth and reproduction of hydrophytic vegetation (USDA, 2006b).

Erosion is defined as the wearing away of the land surface by water, wind, ice, or other geologic events (USDA, 2006b).

Soil limitations for the potential of depth to bedrock within 60 inches of ground surface were obtained from the SSURGO database. The presence of bedrock in the top 7 feet of soil (anticipated depth of pipeline trench) could result in a need for blasting during construction.

Successful restoration and revegetation is important for maintaining agricultural productivity and to protect the underlying soil from potential damage, such as erosion.

Soil association drainage characteristics were obtained from the SSURGO database. These drainage characteristics refer to the frequency and duration of saturation or partial saturation under natural soil conditions. Seven natural soil drainage classes are recognized by the USDA: excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained (USDA, 2006b).

3.4.2 Steele City Segment - Montana

The soils in the northern portion of Montana generally formed in glacial till. Some glacial lacustrine deposits occur and shale may be exposed on some uplands. Small areas of alluvial deposits occur along rivers and drainageways. The soils are generally very deep, well drained, and loamy or clayey. Soils such as Natrustalfs (Elloam and Thoeny series) and Haplustalfs (Phillips series) formed in till on till plains. Ustorthents (Hillon and Sunburst series) formed in till on till plains and hills. Argiustolls formed in till on till plains and hills (Bearpaw, Joplin, Scobey, Telstad, and Vida series) and in alluvium on alluvial fans, stream terraces, and hills (Ethridge and Evanston series).

From McCone County south to Fallon County the soils formed on old plateaus and terraces that eroded. Slopes generally are gently rolling to steep. Steeply sloping badlands border a few of the larger river valleys. In some areas flat-topped, steep-sided buttes rise sharply above the general level of the plains. The soils are generally shallow to very deep, well drained, and clayey or loamy. In areas of cretaceous shales, soils with high bentonite clay contents may occur, such as the Neldore series. These soils frequently have saline or sodic soil chemical properties. Figure 3.3-1 depicts soils that may be susceptible

to erosion due to cretaceous shale parent materials. See Section 3.3.1.4 for further discussion on the landslide-prone and clay soils prone to shrink-swell in Montana.

Other soils that occur in the area such as Ustorthents formed in residuum on hills and ridges (Cabba, Cabbart, and Yawdim series). Ustifluvents (Havre series) formed in alluvium on fans, terraces, and flood plains. Haplustepts (Busby, Cherry, Delpoint, Lonna, and Yamacall series) formed in alluvium, eolian deposits, and residuum on terraces, fans, and hills. Calciustepts (Cambeth series) formed in alluvium, colluvium, and residuum on fans, hills, and plains. Natrustalfs (Gerdrum series) and Haplustolls (Shambo series) formed in alluvium and glaciofluvial deposits on fans and terraces and in drainageways.

Table 3.4-1 Summary of Sensitive Soils along the Project

State/County	Total Miles[1]	Highly Erodible		Prime Farmland[2]	Hydric[3]	Compaction Prone[4]	Stony – Rocky[5]	Shallow Bedrock[6]	Droughty[7]
		Wind	Water						
Steele City Segment									
Montana	282.3	7.5	104.6	68.8	1.4	231.6	37.0	4.6	22.5
South Dakota	312.8	16.5	108.7	103.7	5.0	250.4	9.3	1.2	66.6
Nebraska	255.2	87.4	74.7	104.5	21.7	120.5	12.9	0.3	77.3
Gulf Coast Segment									
Oklahoma	154.9	13.7	28.6	66.4	5.7	127.3	36.1	14.2	21.9
Texas	370.5	44.4	35.3	193.0	88.5	338.5	7.2	37.4	49.4
Project Total[8]	1375.7	169.5	351.9	536.4	122.3	1068.3	102.5	57.7	237.7

[1] Table includes construction of pipeline only. Individual soils may occur in more than one characteristic class.

[2] Includes land listed by the NRCS (2007) as potential prime farmland if adequate protection from flooding and adequate drainage are provided.

[3] As designated by the NRCS (2007).

[4] Includes soils that have clay loam or finer textures

[5] Includes soils that have either: 1) a cobbly, stony, bouldery, gravelly, channery, flaggy, or shaly modifier to the textural class, or 2) have >five percent (weight basis) of stones larger than three inches in the surface layer.

[6] Includes soils that have lithic bedrock within 60 inches of the soil surface.

[7] Includes coarse-textured soils (sandy loams and coarser) that are moderately well to excessively drained.

[8] Discrepancies in total mileage are due to rounding.

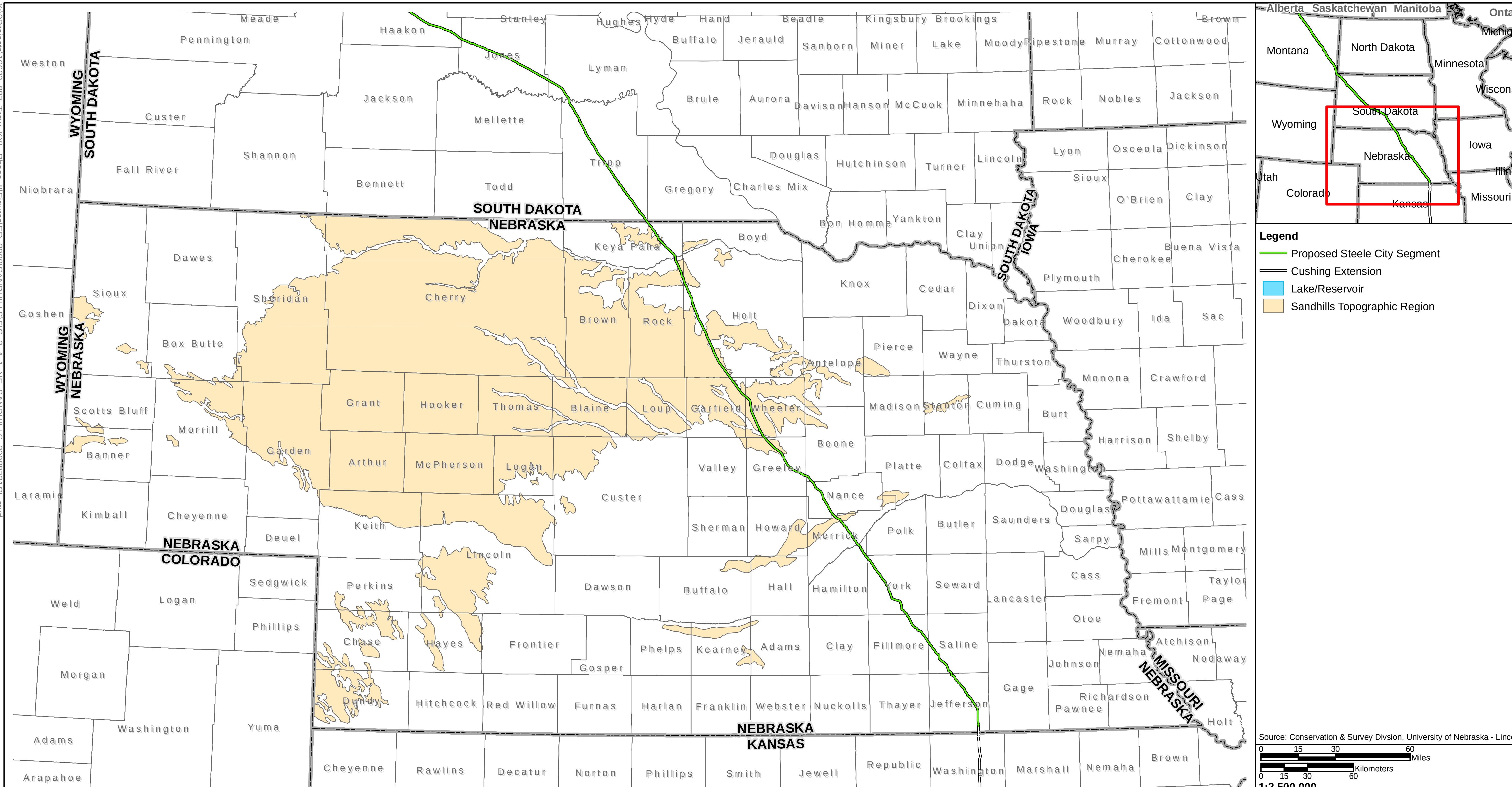
Table 3.4-2 Average Topsoil Depth and Slope Class Along the Proposed Project

State/County	Total Miles[1]	Topsoil[2] (miles)					Slope Class[3] (miles)				
		0-6	>6-12	>12-18	>18-24	>24	0-5	>5-8	>8-15	>15-30	>30
Steele City Segment											
Montana	282.3	237.9	41.2	2.5	0.4	0.2	153.6	41.6	48.0	36.8	2.3
South Dakota	312.8	132.8	39.1	6.3	18.2	116.4	160.8	38.1	96.7	16.2	1.0
Nebraska	255.2	109.3	77.6	30.6	17.9	19.8	156.8	19.2	24.6	53.6	1.0
Gulf Coast Segment											
Oklahoma	154.9	3.2	7.0	7.3	9.0	128.2	106.5	15.3	26.0	6.7	0.4
Texas	323.3	45.5	14.0	16.4	12.1	235.3	266.4	10.4	41.6	4.9	0.0
Houston Lateral											
Texas	47.2	7.3	0.9	1.5	0.7	36.9	47.2	<0.1	0.0	0.0	0.0
Project Total	1375.7	536	179.9	64.7	58.3	536.8	891.3	124.6	236.9	118.2	4.7

[1] Table includes construction of new pipeline only. Mileage dose not include pipeline in NE, KS, and OK constructed as the Keystone Cushing Extension under the Keystone Pipeline Project.

[2] Topsoil depth was determined by the depth of the upper horizon layer with greater than, or equal to 1 percent organic matter, as provided in the SSURGO database for each map unit identification (MUID) component soil series.

[3] Slopes are grouped by the averages of the high and low slope ranges provided in the SSURGO database for each MUID component soil series.



TransCanada Keystone XL Project

Figure 3.4-1

Sandhills Topographic Region

X:\Projects\10623_007_Trow_KXL_Phase_II\Figures\ER_2008\SANDHILLS\FIG_3_4_1_NE_SANDHILLS_20080731CL.mxd

Prime farmland soils occupy 24% of the proposed route in Montana. Other sensitive soils crossed include less than one percent with hydric soils, 64 percent with low reclamation potential, and 1.6 percent with shallow bedrock. Details are listed in Table 3.4-1 and 3.4-2. The typical freeze-free period ranges from 120 to 165 days.

3.4.3 Steele City Segment - South Dakota

In the northwestern portions of South Dakota, the soils are shallow to very deep, generally well drained, and loamy or clayey. Soils such as the Assinniboine series formed in fluvial deposits that occur on fans, terraces, and till plains. Soils such as the Cabbart, Delridge, and Blackhall series formed in residuum on hills and plains.

Fertile soils and smooth topography dominate Meade County. The soils are generally shallow to very deep, somewhat excessively drained to moderately well drained, and loamy or clayey. Cretaceous Pierre Shale underlies almost all of Hakkon, Jones, and portions of Tripp Counties. This shale weathers to smectitic clays. These clays shrink as they dry and swell as they get wet, causing significant problems for road and structural foundations. See section 3.3.2.4 for further discussion on the landslide-prone and clay soils prone to shrink-swell in South Dakota.

From central Tripp County to the Nebraska state line, soils typically are derived from shale and clays on the flatter to moderately sloping, eroded tablelands. Steeper slopes occur on the sides of ridges and along drainages. Soils commonly located in the tablelands include the Anselmo, Lakoma, Manter, Millboro, Okaton, Opal, Ree, Reliance, Sansarc, and Witten series. Most of these soils have thick, dark, organically enriched topsoil layers. Most of the soils are clayey and have shale at varying depths. These soils are scattered throughout Tripp County, occupying almost half the ROW length. The route also crosses deep, sandy deposits on which the Doger, Dunday, and Valentine soils formed. These are dry, rapidly permeable soils. Topsoil layers are thin and droughty, and wind erosion and blowouts are a common hazard.

Prime farmland soils occupy approximately 33 percent of the proposed route in South Dakota. Other sensitive soils crossed include 1.6 percent with hydric soils, 43 percent with low reclamation potential, and less than one percent with shallow bedrock. Details are listed in Table 3.4-1 and 3.4-2. The typical freeze-free period ranges from 135 to 165 days (NRCS 1981).

3.4.4 Steele City Segment - Nebraska

Soil characteristics along the proposed route in northern Nebraska are similar to those described for southern South Dakota. Soils in parts of Keya Paha County are derived from shale and clays on the flatter to moderately sloping, eroded tablelands. These soils have thick, dark, organically-enriched topsoil layers and are clayey with shale at varying depths. These clayey soils are widely dispersed, but occupy only about 2.2 miles of the ROW in the county as it transitions to the Nebraska Sand Hills (Figure 3.4-1). Sandy soils begin to dominate the landscape throughout most of Rock, Holt, Garfield, Wheeler, and portions of Greeley Counties (approximately MP 595.2 to MP 707.3). The soils are generally are very deep, excessively drained to somewhat poorly drained, and sandy. Ustipsamments formed in sandy eolian material on dunes (Valentine series) and a mixture of sandy eolian material and sandy alluvial material on hummocks and terraces (Ipage series) and in swales (Els series). Haplustolls formed in sandy eolian material in areas between dunes and on stream terraces (Dunday series) and in a mixture of sandy eolian material and sandy alluvial material in swales and on stream terraces (Elsmere series) (NRCS 2006). Blowouts are common in the Sand Hills. Blowouts form when the stabilizing vegetation is disturbed, naturally through drought and climate change, or by human activities (Maher et al. 2003).

The soils in the central to southern portion of Nebraska transition into deep loess deposits. Loess have a relatively low crushing strength and become more susceptible to erosion where reworked. The southernmost soils, from Hamilton County south to Jefferson County characteristically have thick, dark, organically-enriched

topsoil layers. Argiustolls such as the Crete, Geary, and Holder series are common along this portion of the route (NRCS 2006).

Prime farmland soils occupy approximately 41 percent of the proposed route in Nebraska. Other sensitive soils crossed include 8.5 percent with hydric soils, 1.6 percent with low reclamation potential, and less than one percent with shallow bedrock soils. Details are listed in Table 3.4-1 and 3.4-2. The typical freeze-free period is 160 to 180 days in Nebraska.

3.4.5 Kansas - Keystone Cushing Extension Pump Stations

In Kansas, construction associated with the Project will be limited to new pump stations in Clay and Butler Counties.

Along the Keystone Cushing Extension in Kansas where the pump stations will be located, sandstones and limestones may outcrop along valley sideslopes and ridge crests. Shallow soils, such as the Hedville series, form in these locations. Elsewhere, the Irwin, Ladysmith, and Geary soil series occur where silty loess deposits mantle the bedrock on uplands. These are deep soils with fertile topsoils and loamy or clayey subsoils. Along smaller streams, Hobbs soils commonly occur. These are deep, stratified soils with fertile topsoils. In some locations, the topsoil layer may have a thickness of 20 inches or more. Most of the land along the Keystone Cushing Extension is used for agricultural purposes. The typical freeze-free period is 170 to 190 days (USDA-SCS 1981).

3.4.6 Gulf Coast Segment - Oklahoma

Ecoregions denote areas of similar ecosystems and in the type, quality, and quantity of environmental recourses. Oklahoma is divided into twelve major eco regions and this Project only crosses 7 ecoregions.

The Central Great Plains are slightly lower, receive more precipitation, and are more irregular than the Western High Plains. Much of this area, once grassland with scattered low trees and shrubs in the south, is now cropland. The eastern boundary of the region marks the eastern limits of the maker winter wheat growing area of the United States. The northern portion of Lincoln County is included in the Central Great Plains ecoregion.

The Cross Timbers ecoregion is a transition area between the once prairie, now winter wheat growing regions to the west, and the forested, low mountains of eastern Oklahoma. The region does not possess the arability and suitability for crops such as corn and soybeans common in the Central Irregular Plains to the northeast. Transitional “cross-timbers” is the native vegetation, and presently rangeland and pastureland compromise the predominant land cover. Oil extraction has been a major activity in this region for over eighty years. Counties included within the Cross Timbers ecoregion are Lincoln, Creek, Okufskee, Seminole, Hughes, Atoka, Coal, and Bryan.

The Arkansas Valley ecoregion separates the Ozark Plateau from the Ouachita Mountains. It is characteristically transitional and diverse. Plains, hills, floodplains, terraces, and scattered mountains all occur; the terrain is distant from nearby ecoregions. A mix of oak savannah, prairie, oak hickory pine forest, and oak hickory forest is native on uplands. Counties included in the Arkansas Valley ecoregion are Seminole, Hughes, Coal, and Atoka.

The Ouachita Mountains region is made up of sharply defined east-west trending ridges, formed through erosion of compressed sedimentary rock formations. Once covered by oak hickory pine forests, most of these regions are now in loblolly and shortleaf pine. Portions of Atoka County are in the Ouachita Mountain ecoregion.

The South Central Plains ecoregion is locally termed the “piney woods.” This region consists mostly of irregular plains that were once oak hickory pine forests. The area is now predominantly in loblolly and shortleaf pine. Only a small portion of the area is cropland. Counties included in the South Central Plains are Coal, Atoka, and Bryan.

The east Central Texas Plains ecoregion is also known as the Claypan Area. This region of irregular plains was originally covered by post oak savannah vegetation.

Oklahoma soils associated with the Project are comprised of many soils series totaling 2294 acres. Sensitive soils crossed include 34 percent of prime farmland, 3 percentof hydric soils, and 9 percent of shallow bedrock. Details are listed in Table 3.4-1 and 3.4-2.

3.4.7 Gulf Coast Segment and Houston Lateral - Texas

Soils to be crossed by the Project lay in the Gulf Coastal Plains physiographic region. The Gulf Coastal Plains includes three subprovinces: the Blackland Prairies, the Interior Coastal Plains, and the Coastal Prairies.

The Blackland Prairie subprovince includes Fannin, Lamar, Delta, Hopkins, and Franklin Counties. On the Blackland Prairies of the innermost Gulf Coastal Plains, chalks and marls weather to deep, black, fertile clay soils. The blacklands have a gently undulating surface, clear of most natural vegetation and are cultivated for crops (Wermund 2008).

The Interior Coastal Plains subprovince includes Wood, Upshur County, Smith Cherokee, and Rusk Counties. The Interior Coastal Plains comprise alternating belts of resistant uncemented sands among weaker shales that erode into long, sandy ridges. The region is characterized by pine and hardwood forest and numerous permanent streams (Wermund 2008).

The Coastal Prairies subprovince includes Nacogdoches, Angelina, Polk, Liberty, Hardin, Jefferson, and Harris Counties. The Coastal Prairies, which begin at the Gulf of Mexico shoreline, is characterized by young deltaic sands, silts and clays that erode to nearly flat grasslands that form almost imperceptible slopes to the southeast. Trees are uncommon except along major streams or on coarser underlying sediments of ancient streams (Wermund 2008).

Texas soils crossed by the Gulf Coast Segment and Houston Lateral are comprised of many soils series totaling 5636 acres. Sensitive soils crossed include 40 percent of prime farmland, 18 percent of hydric soils, and 13 percent of shallow bedrock. Details are further listed in Table 3.4-1 and 3.4-2.

3.5 Water Resources

3.5.1 Surface Water

Surface water resources along the Project route are located in three water resource regions, as identified by their major river systems (Seaber et al. 1994):

- Missouri River Region (in Montana, South Dakota, Nebraska and Northern Kansas);
- Arkansas-White-Red Rivers Region (in Southern Kansas, Oklahoma and Northern Texas); and
- Texas-Gulf rivers region (in Texas).

Waterbodies downstream of the proposed route are depicted in Figure 3.5-1. Appendix E is a detailed tabulation of the stream crossings associated with the proposed route.

3.5.1.2 Steele City Segment - Montana

As the proposed Steele City Segment traverses Montana, the major stream crossings include Frenchman Creek just above Frenchman Reservoir, Rock Creek and tributaries, and the Milk River and tributaries in Valley County. The Missouri River will be crossed at the Valley-McCone County Line, just over 1 mile below the Fort Peck Dam, where the river is approximately 1,000 feet wide. The drainage area of Fort Peck Reservoir is traversed in McCone County, where the proposed route is never closer than 2 miles to Fort Peck Reservoir and is separated from the reservoir by State Highway 24. The proposed route crosses Bear Creek, a tributary to the Fort Peck Reservoir, approximately 14 miles upstream from the reservoir in McCone County. Prairie Elk Creek is crossed in McCone County. The Redwater River and tributaries are crossed in McCone and Dawson Counties; Clear Creek, and the Yellowstone River and tributaries are crossed in Dawson County; Cabin Creek and tributaries are crossed in Prairie County; and tributaries of O'Fallon Creek, Little Beaver Creek and tributaries, and Boxelder Creek and tributaries are crossed in Fallon County. Reservoirs and lakes are common near or downstream from the Project, as indicated in Table 3.5-1 [10-mi downstream]. Table 3.5-2 lists canals and levees that will be crossed by the proposed pipeline.

3.5.1.3 Steele City Segment - South Dakota

In South Dakota, major stream crossings in Harding County include the Little Missouri River and tributaries, South Fork Grand River, and Clarks Fork Creek. Additionally, the North Fork Moreau River in Butte County, the South Fork Moreau River in Perkins County, and Sulphur Creek and tributaries in Meade County are all crossed by the proposed route. The Cheyenne River, a sand and gravel bottomed braided channel approximately 1,000 feet wide, will be crossed at the Meade and Pennington county line, as well as several tributaries to the Cheyenne Rivers. The proposed Project will cross the Bad River and its tributaries in Haakon County at a point where the river is a relatively small pool-riffle type river with an ordinary high water mark width of 25 feet and a floodplain width of 200 feet. The proposed pipeline route crosses Dry Creek and Williams Creek in Jones County. The White River will be crossed at the Lyman and Tripp county line where the river has a braided channel approximately 500 feet wide. Several tributaries to the White River will be crossed in Lyman and Tripp Counties. Stream crossings in Tripp County will include Cottonwood Creek, Ponca Creek, and Buffalo Creek.

3.5.1.4 Steele City Segment - Nebraska

Major stream crossings in Nebraska include the Keya Paha River and tributaries in Keya Paha County. The Niobrara River is crossed approximately 1.5 miles downstream of the Wild and Scenic River designation at the Keya Paha and Rock county line where it is a sandy-bottomed, braided channel approximately 1,300 feet wide. Other major stream crossings include the North and South Fork Elkhorn Rivers and their tributaries in Holt County; the Cedar River in Wheeler County; and the Loup River in Nance County. In Merrick County, the Platte River crossing is a highly braided stream in sandy floodplain deposits up to 3 miles wide, with a channel approximately 2,000 feet wide. The proposed pipeline crosses the Big Blue River and tributaries, which include the West Fork Big Blue River in York County; Turkey Creek in Fillmore County; and South Fork Swan Creek and Cub Creek in Jefferson County, east of Steele City.

3.5.1.5 Keystone Cushing Extension Pump Stations - Kansas

The only new disturbance will be associated with the construction and operation of two new pump stations in Kansas No effects are anticipated to surface water due to these pump stations.

Table 3.5-1 Waterbodies Within 10 Miles Downstream of Proposed Crossings

State	County	Stream Crossing Point	Approx. Milepost	Downstream Reservoir/Fishery/Wildlife Area	Other Description
Steele City Segment					
Montana					
	Phillips	N/A	2.0	Lester Reservoir	Small reservoir in cultivated field approx. 0.3 miles from Pipeline
	Phillips, Valley	Frenchman Creek and tribs	20.8 - 25.9	Frenchman Reservoir	Pipeline passes approx. ½ mile upstream on Frenchman Cr.
	Valley	Tribs Bear Creek	49.3 - 49.6	Reservoir Number Four	Pipeline passes within 0.1 miles of reservoir
	Valley	Oxbow Milk River	Milk River Floodplain	Unnamed Reservoir	Pipeline passes within approx. 0.1 miles of oxbow on floodplain
	McCone	Tribs Fort Peck Reservoir including Bear Creek	102.3 - 105.4	Fort Peck Lake and Charles M. Russell Wildlife Refuge	Highway 24 is located between Project and Reservoir
	McCone	Trib North Prong Shade Creek	106.5 - 107.7	North Dam	Pipeline passes within 0.1 miles of reservoir
	McCone	Trib South Fork Shade Creek	113.6	Christianson Reservoir	Pipeline passes within 0.1 miles of reservoir
	McCone	Tribs Lost Creek	134.3 - 136.1	Unnamed Reservoir	Downstream from Haynie Reservoir, with add'l tribs.
	McCone	Tribs Lost Creek	139.2 – 140.9	Unnamed Reservoir	
	Dawson	Upper Sevenmile Creek	166.1	Lindsay Reservoir	Approx. 10 river miles downstream
	Fallon	Red Butte Creek and tribs	246.0 – 252.8	Red Butte Dam	
South Dakota					
	Harding	Tribs Jones Creek	302.3 – 307.2	Unnamed Reservoir	Approx. 10 river miles downstream
	Harding	Tribs Rush Creek	308.0 – 309.3	Lake Gardner	
	Harding	Tribs Sheep Creek	310.8 – 313.4	Unnamed Reservoir	
	Harding	West Squaw Creek and tribs	328.2 – 331.5	Unnamed Reservoir	State Experiment Farm and Antelope Reserve
	Haakon	Witcher Holes Creek and tribs	458.6 – 461.0	Unnamed Reservoir	
	Haakon	Squaw Creek	464.4	Unnamed Reservoir	

Table 3.5-1 Waterbodies Within 10 Miles Downstream of Proposed Crossings

State	County	Stream Crossing Point	Approx. Milepost	Downstream Reservoir/Fishery/Wildlife Area	Other Description
Nebraska					
	Holt	Keegan Creek, Elkhorn River and tribs	627.1 – 634.5	Atkinson Reservoir	Atkinson Lake Recreation Area
	Holt	N/A	666.5 – 667.5	Chain Lake	Pipeline passes within approx. 0.4 miles of lake
	Holt, Garfield	N/A	667.8 – 668.6	Unnamed Lake	Pipeline crosses lake
	Garfield	N/A	669.0 – 670.0	Rush Lake	Pipeline passes within approx. 0.4 miles of lake
	York	Trib Beaver Creek	776.1	Unnamed Reservoir	
	York	N/A	781.1	Unnamed Reservoir	Pipeline passes within 0.1 miles of reservoir
	York	N/A	791.5 – 793.0	Sininger Lagoon, County Line Marsh	National Waterfoul Management Area; Pipeline passes within 0.1 miles of reservoir
	Saline	Tribs Swan Creek	813.4 – 814.8	Unnamed Reservoir	
	Saline	Tribs Swan Creek	819.4 – 821.9	Unnamed Reservoir	
	Jefferson	Tribs Cub Creek	830.6 – 831.2	Cub Creek Reservoir 14-C	
	Jefferson	Trib Cub Creek	837.2	Cub Creek Reservoir 13-C	Pipeline passes within 0.2 miles of reservoir
	Jefferson	Trib Big Indian Creek	839.0	Big Indian Creek Reservoir 10-A	Pipeline passes within 0.3 miles of reservoir
	Jefferson	Tribs Big Indian Creek	845.8 – 847.4	Big Indian Creek Reservoir 8-E	
Gulf Coast Segment					
Oklahoma					
	Lincoln	Perennial tributary to Camp Creek	8.4	Stroud Lake	Perennial drainage flows southeast from the centerline into Stroud Lake via Camp Creek.
	Lincoln	Ephemeral tributary to Camp Creek	8.4	Stroud Lake	Ephemeral drainage flows southeast from the centerline into Stroud Lake via Camp Creek.
	Lincoln	Camp Creek	8.6	Stroud Lake	
	Lincoln	Intermittent tributary to Camp Creek	9.9	Stroud Lake	Intermittent drainage flows northeast from centerline into Stroud Lake via Camp Creek.
	Lincoln	Unnamed	9.94	Stroud Lake	

Table 3.5-1 Waterbodies Within 10 Miles Downstream of Proposed Crossings

State	County	Stream Crossing Point	Approx. Milepost	Downstream Reservoir/Fishery/Wildlife Area	Other Description
Texas					
	Lamar	Intermittent tributary to Shooter Creek	167.9	Pat Mayse Lake	Intermittent drainage flows east from centerline into Pat Mayse Lake via Shooter Creek.
	Lamar	Shooter Creek	168.3	Pat Mayse Lake	
	Lamar	Collins Creek	168.5	Pat Mayse Lake	
	Lamar	Ephemeral tributary to Sanders Creek	169.3	Pat Mayse Lake	Ephemeral drainage flows east from centerline into Pay Mayse Lake via Sanders Creek.
	Lamar	Ephemeral tributary to Sanders Creek	169.4	Pat Mayse Lake	Ephemeral drainage flows east from centerline into Pay Mayse Lake via Sanders Creek.
	Lamar	Cottonwood Creek	171.7	Pat Mayse Lake	
	Franklin	Little Cypress Creek	223.1	Lake Bob Sandlin	
	Franklin	Intermittent tributary to Little Cypress Creek	224.0	Lake Bob Sandlin	Intermittent drainage flow west from centerline into Lake Bob Sandlin via Little Cypress Creek
	Franklin	Ephemeral tributary to Little Cypress Creek	224.3	Lake Bob Sandlin	Ephemeral drainage flow west from centerline into Lake Bob Sandlin via Little Cypress Creek.
	Franklin	Intermittent tributary to Little Cypress Creek	224.8	Lake Bob Sandlin	Intermittent drainage flow west from centerline into Lake Bob Sandlin via Little Cypress Creek
	Franklin	Intermittent tributary to Little Cypress Creek	224.9	Lake Bob Sandlin	Intermittent drainage flow west from centerline into Lake Bob Sandlin via Little Cypress Creek
	Franklin	Intermittent tributary to Little Cypress Creek	225.8	Lake Bob Sandlin	Intermittent drainage flow west from centerline into Lake Bob Sandlin via Little Cypress Creek
	Franklin	Little Cypress Creek	225.8	Lake Bob Sandlin	
	Franklin	Perennial tributary to Big Cypress Creek	226.6	Lake Bob Sandlin	Perennial drainage flows east from centerline into Lake Bob Sandlin via Big Cypress Creek.
	Franklin	Big Cypress Creek	227.2	Lake Bob Sandlin	
	Franklin	Perennial tributary to Big Cypress Creek	227.6	Lake Bob Sandlin	Perennial drainage flows west from centerline into Lake Bob Sandlin via Big Cypress Creek.
	Franklin	Intermittent tributary to Gum Branch	228.8	Lake Bob Sandlin	Intermittent drainage flows southeast from centerline into Lake Bob Sandlin via Gum

Table 3.5-1 Waterbodies Within 10 Miles Downstream of Proposed Crossings

State	County	Stream Crossing Point	Approx. Milepost	Downstream Reservoir/Fishery/Wildlife Area	Other Description
					Branch.
	Franklin	Ephemeral tributary to Gum Branch	229.3	Lake Bob Sandlin	Ephemeral drainage flows southeast from centerline into Lake Bob Sandlin via Gum Branch.
	Franklin	Ephemeral tributary to Gum Branch	229.7	Lake Bob Sandlin	Ephemeral drainage flows southeast from centerline into Lake Bob Sandlin via Gum Branch.
	Franklin	Ephemeral tributary to Gum Branch	230.0	Lake Bob Sandlin	Ephemeral drainage flows east from centerline into Lake Bob Sandlin via Gum Branch.
	Franklin	Ephemeral tributary to Brushy Creek	230.9	Lake Bob Sandlin	Ephemeral drainage flows east from centerline into Lake Bob Sandlin via Brushy Creek.
	Franklin	Intermittent tributary to Brushy Creek	231.5	Lake Bob Sandlin	Intermittent drainage flows east from centerline into Lake Bob Sandlin via Brushy Creek.
	Franklin	Brushy Creek	231.6	Lake Bob Sandlin	
	Franklin	Intermittent tributary to Brushy Creek	231.6	Lake Bob Sandlin	Intermittent drainage flows east from centerline into Lake Bob Sandlin via Brushy Creek.
	Wood	Intermittent tributary to Briary Creek	232.8	Lake Bob Sandlin	Intermittent drainage flows east from centerline into Lake Bob Sandlin via Briary Creek.
	Wood	Briary Creek	232.9	Lake Bob Sandlin	
	Wood	Sand Branch	233.3	Lake Bob Sandlin	
	Wood	Perennial tributary to Sand Branch	233.8	Lake Bob Sandlin	Perennial drainage flows east from centerline into Lake Bob Sandlin via Sand Branch.
	Wood	Perennial tributary to Sand Branch	234.3	Lake Bob Sandlin	Perennial drainage flows northeast from centerline into Lake Bob Sandlin via Sand Branch.
	Wood	Intermittent tributary to Sand Branch	235.5	Lake Bob Sandlin	Intermittent drainage flows northeast from centerline into Lake Bob Sandlin via Sand Branch
	Wood	Clear Creek	247.2	Lake Greenbriar	

Table 3.5-1 Waterbodies Within 10 Miles Downstream of Proposed Crossings

State	County	Stream Crossing Point	Approx. Milepost	Downstream Reservoir/Fishery/Wildlife Area	Other Description
	Smith	Intermittent tributary to Mud Creek	275.5	Lake Tyler/Lake Tyler East	Intermittent drainage flows west of centerline into Lake Tyler East via Mud Creek.
	Smith	Seasonal tributary to Mud Creek	277.0	Lake Tyler/Lake Tyler East	Seasonal drainage flows west of centerline into Lake Tyler East via Mud Creek.
	Smith	Perennial tributary to Mud Creek	279.1	Lake Tyler/Lake Tyler East	Perennial drainage flows west of centerline into Lake Tyler East via Mud Creek.
	Smith	Ephemeral tributary to Caney Creek	280.2	Lake Tyler/Lake Tyler East	Ephemeral drainage flows southwest of centerline into Lake Tyler East via Caney Creek.
	Smith	Intermittent tributary to Caney Creek	280.4	Lake Tyler/Lake Tyler East	Intermittent drainage flows southwest of centerline into Lake Tyler East via Caney Creek.
	Smith	Intermittent tributary to Caney Creek	280.4	Lake Tyler/Lake Tyler East	Intermittent drainage flows southwest of centerline into Lake Tyler East via Caney Creek.
	Smith	Intermittent tributary to Caney Creek	281.5	Lake Tyler/Lake Tyler East	Intermittent drainage flows south of centerline into Lake Tyler East via Caney Creek.
	Smith	Intermittent tributary to Caney Creek	281.7	Lake Tyler/Lake Tyler East	Intermittent drainage flows south of centerline into Lake Tyler East via Caney Creek.
	Smith	Caney Creek	282.0	Lake Tyler/Lake Tyler East	
	Smith	Perennial tributary to Caney Creek	283.0	Lake Tyler/Lake Tyler East	Perennial drainage flows north parallel of centerline into Lake Tyler East via Caney Creek.
	Smith	Intermittent tributary to Kickapoo Creek	284.8	Lake Columbia	Intermittent drainage flows west of centerline into Columbia Lake via Kickapoo Creek.
	Smith	Perennial tributary to Kickapoo Creek	284.9	Lake Columbia	Perennial drainage flows west of centerline into Columbia Lake via Kickapoo Creek.
	Rusk	Johnsons Creek	299.7	Lake Striker	
	Rusk	Ephemeral tributary to Striker Creek	300.1	Lake Striker	Ephemeral drainage flows west of centerline into Lake Striker via Striker Creek.
	Rusk	Ephemeral tributary to Striker Creek	300.6	Lake Striker	Ephemeral drainage flows west of centerline into Lake Striker via Striker Creek.

Table 3.5-1 Waterbodies Within 10 Miles Downstream of Proposed Crossings

State	County	Stream Crossing Point	Approx. Milepost	Downstream Reservoir/Fishery/Wildlife Area	Other Description
	Rusk	Ephemeral tributary to Boggy Branch	301.3	Lake Striker	Ephemeral drainage flows west of centerline into Lake Striker via Boggy Branch.
	Rusk	Boggy Branch	301.4	Lake Striker	
	Cherokee	Perennial tributary to Mill Creek	296.0	Lake Striker	Perennial drainage flows east of centerline into Lake Striker via Mill Creek.
	Cherokee	Perennial tributary to Mill Creek	296.0	Lake Striker	Perennial drainage flows east of centerline into Lake Striker via Mill Creek.
	Cherokee	Mill Creek	296.0	Lake Striker	
	Cherokee	Ephemeral tributary to Bowles Creek	299.1	Lake Striker	Ephemeral drainage flows east of centerline into Lake Striker via Bowles Creek.
	Angelina	Intermittent tributary to Joiner Branch	343.3	David Crockett National Forest	Intermittent drainage located within David Crockett National Forest which drains east into Joiner Branch
	Angelina	Joiner Branch	343.4	David Crockett National Forest	
	Angelina	Perennial tributary to Joiner Branch	343.5	David Crockett National Forest	Perennial drainage located within David Crocket National Forest which drains east into Joiner Branch
	Angelina	Perennial tributary to Buncombe Creek	349.0	David Crockett National Forest	Perennial drainage located within David Crocket National Forest which drains west into Buncombe Creek.
	Angelina	Ephemeral tributary to Buncombe Creek	349.1	David Crockett National Forest	Ephemeral drainage located within David Crocket National Forest which drains west into Buncombe Creek.
	Angelina	Ephemeral tributary to Crawford Creek	349.8	David Crockett National Forest	Ephemeral drainage located within David Crocket National Forest which drains west into Crawford Creek.
	Angelina	Ephemeral tributary to Crawford Creek	350.8	David Crockett National Forest	Ephemeral drainage located within David Crocket National Forest which drains west into Crawford Creek.
	Angelina	Crawford Creek	351.0	David Crockett National Forest	
	Polk	Ephemeral tributary to Caney Creek	389.9	Big Thicket National Preserve	Ephemeral drainage located within Big Thicket National Preserve which drains northeast into

Table 3.5-1 Waterbodies Within 10 Miles Downstream of Proposed Crossings

State	County	Stream Crossing Point	Approx. Milepost	Downstream Reservoir/Fishery/Wildlife Area	Other Description
					Caney Creek.
	Polk	Ephemeral tributary to Caney Creek	390.0	Big Thicket National Preserve	Ephemeral drainage located within Big Thicket National Preserve which drains northeast into Caney Creek.
	Polk	Ephemeral tributary to Bluff Creek	396.8	Big Thicket National Preserve	Ephemeral drainage located within Big Thicket National Preserve which drains southeast into Bluff Creek.
	Polk	Ephemeral tributary to Williams Creek	407.7	Big Thicket National Preserve	Ephemeral drainage located within Big Thicket National Preserve which drains south into Williams Creek.
	Polk	Ephemeral tributary to Williams Creek	409.6	Big Thicket National Preserve	Ephemeral drainage located within Big Thicket National Preserve which drains west into Williams Creek.
	Polk	Ephemeral tributary to Bear Foot Lake	411.3	Big Thicket National Preserve	Ephemeral drainage located within Big Thicket National Preserve which drains east into Bear Foot Lake.
	Liberty	Intermittent tributary to Menard Creek	412.3	Big Thicket National Preserve	Intermittent drainage located within Big Thicket National Preserve which drains south into Menard Creek.
	Jefferson	Intermittent tributary to Rhodair Gully	474.8	J D Murphree WMA	Intermittent drainage flows south from the centerline into J.D. Murphree WMA via Rhodair Gully.
	Jefferson	Intermittent tributary to Rhodair Gully	474.9	J D Murphree WMA	Intermittent drainage flows south from the centerline into J.D. Murphree WMA via Rhodair Gully.
	Jefferson	Perennial tributary into Big Thicket NPRES	455.9	Big Thicket National Preserve	Perennial drainage flows north from the centerline into Big Thicket National Preserve via Pine Island Bayou
	Jefferson	Perennial tributary into Big Thicket NPRES	456.5	Big Thicket National Preserve	Perennial drainage flows north from the centerline into Big Thicket National Preserve via Pine Island Bayou
	Jefferson	Perennial tributary into J.D.	470.3	J.D. Murphree WMA	Perennial drainage flows southwest from the

Table 3.5-1 Waterbodies Within 10 Miles Downstream of Proposed Crossings

State	County	Stream Crossing Point	Approx. Milepost	Downstream Reservoir/Fishery/Wildlife Area	Other Description
		Murphree WMA			centerline into J.D. Murphree WMA via Hillebrandt Bayou.
Houston Lateral					
Texas					
	Liberty	Intermittent tributary of Long Island Creek	6.4	Daisetta Swamp	Intermittent drainage canal that flows east from the centerline into Daisetta Swamp via Long Island Creek.
	Liberty	Redmond Creek	14.7	Wallisville Lake	
	Liberty	Buck Gully	28.0	Old River Lake	
	Liberty	Ephemeral tributary of Buck Gully	28.1	Old River Lake	Ephemeral drainage that flows south from the centerline into Old River lake via Buck Gully.
	Harris	San Jacinto River Authority Canal	40.1	Highlands Reservoir	

Table 3.5-2 Levees and Water Control Structures

State	County	Approx. Milepost	Type of Flood Protection Structure	Waterbody
Steele City Segment				
Montana				
	Phillips	22.5	Canal/Ditch	Unknown
	Valley	39.1	Canal/Ditch	Unknown
	Valley	59.3	Canal/Ditch	Unknown
	Valley	84.2, 84.3, 84.7	Canal/Ditch	Vandalia South Canal
	Valley	87.5	Canal/Ditch	Unknown
	Valley	87.7	Canal/Ditch	Unknown
	Valley	88.0	Canal/Ditch	Unknown
	Valley	88.0	Canal/Ditch	Unknown
	Valley	88.3	Canal/Ditch	Unknown
	Valley	88.5	Canal/Ditch	Unknown
	Valley	88.7	Canal/Ditch	Unknown
	Dawson	193.9	Canal/Ditch	Main Canal
	Dawson	195.0	Canal/Ditch	Lateral Main Canal
South Dakota				
	None			
Nebraska				
	Holt	632.3	Canal/Ditch	Unknown
	Greeley	701.9	Canal/Ditch	Unknown
	Merrick	749.4	Canal/Ditch	Unknown
	Filmore	797.9	Canal/Ditch	Unknown
	Filmore	799.9	Canal/Ditch	Trib. Turkey Creek
	Saline	822.4	Canal/Ditch	Unknown
Gulf Coast Segment				
Oklahoma				
	Hughes	70.6	Artificial Path	Little River
	Hughes	74.4	Artificial Path	Canadian River
	Bryan/Fannin	154.8	Artificial Path	Red River
Texas				
	Jefferson	466.0	Canal/Ditch	Willow Marsh Bayou

Table 3.5-2 Levees and Water Control Structures

State	County	Approx. Milepost	Type of Flood Protection Structure	Waterbody
	Jefferson	467.6	Canal/Ditch	Willow Marsh Bayou
	Jefferson	469.3	Artificial Path	Hillebrandt Bayou
	Jefferson	460.2	Canal/Ditch	Unavailable
	Jefferson	459.3	Canal/Ditch	Unavailable
	Jefferson	458.5	Canal/Ditch	Unavailable
	Jefferson	458.1	Canal/Ditch	Unavailable
	Jefferson	462.2	Canal/Ditch	Unavailable
	Jefferson	461.7	Canal/Ditch	Gallier Canal
	Jefferson	457.9	Canal/Ditch	Lower Neches Valley Authority Canal
	Jefferson	457.6	Canal/Ditch	Lower Neches Valley Authority Canal
	Jefferson	476.3	Canal/Ditch	Unavailable
Houston Lateral				
Texas				
	Liberty	10.1	Canal/Ditch	Abbott Creek Canal
	Liberty	21.8	Artificial Path	Trinity River
	Harris	38.1	Canal/Ditch	Highlands Reservoir Canal
	Harris	40.2	Canal/Ditch	Highlands Reservoir Canal
	Harris	43.3	Artificial Path	San Jacinto River

3.5.1.6 Gulf Coast Segment - Oklahoma

In the Gulf Coast Segment of the Project in Oklahoma, beginning in Creek County, the major water drainages crossed by the proposed pipeline include the Deep Fork River and many of its smaller tributaries. Continuing south, major crossings in Okfuskee County include the Canadian River and several of its tributaries. Several tributaries to the Deep Fork River are also crossed. Several tributaries of the Canadian River are crossed in Seminole County. The Little River in Hughes County is crossed along with several of its smaller tributaries. The Red River, the natural boundary of Bryan County in Oklahoma and Fannin County in Texas, is crossed by the proposed pipeline. Several of its tributaries will also be crossed.

3.5.1.7 Gulf Coast Segment - Texas

The Gulf Coast Segment in Texas beginning in Fannin County will cross the Red River as mentioned above and several of its tributaries. Continuing south, the North and South Sulphur Rivers will be crossed in Delta County along with several of its smaller drainages. The Sabine River will be crossed in both Upshur and Smith Counties. The East Fork Angelina River will be crossed in Rusk along with several associated tributaries. In Angelina County, the Angelina River and the Neches River will be crossed. Two of the pump stations in Texas are located in a flood zone.

3.5.1.8 Texas – Houston Lateral

On the Houston Lateral route, major crossings include the Trinity River and several of its minor drainages in Liberty County, Cedar Bayou and minor tributaries in Chambers County and the San Jacinto River in Harris County.

3.5.2 Water Quality

The Clean Water Act (CWA), Section 303(c), requires each state to review, establish, and revise water quality standards for all surface waters within the state. To comply with this requirement, each state developed its own beneficial-use classification system to describe state-designated uses. Regulatory programs for water quality standards include default narrative standards, non-degradation provisions, a Total Maximum Daily Load (TMDL) regulatory process for impaired waters, and associated minimum water quality requirements for the designated uses of listed surface waterbodies within the state.

Where stream segments have been designated by the states, the uses of surface waterbodies at proposed crossings are indicated in Appendix E. Where applicable Appendix E also indicates major uses supported as listed by the individual states and approved by the US EPA. Stream segments listed as impaired by the US EPA, and the reasons for such listing, are further identified in Appendix L.

Because there is a potential that sediment disturbed by pipeline construction could be transported as a natural result of surface flow dynamics, data collection sites included in the National Sediment Quality Survey within 10 stream- or river-miles of the proposed ROW are identified in Table 3.5-3. Sediment quality at Tier 1 sites is such that associated adverse effects on aquatic life or human health are probable. Sediment quality at Tier 2 sites is such that adverse effects on aquatic life or human health are possible. Tier 3 sites are associated with sediment that there is no indication of associated adverse effects. A watershed classified as an Area of Probable Concern (APC) is one in which 10 or more sediment sampling sites are categorized as Tier 1 and at least 75 percent of all sampling stations are categorized as either Tier 1 or Tier 2 (US EPA 2004). No APC-classified watersheds occur along the proposed route.

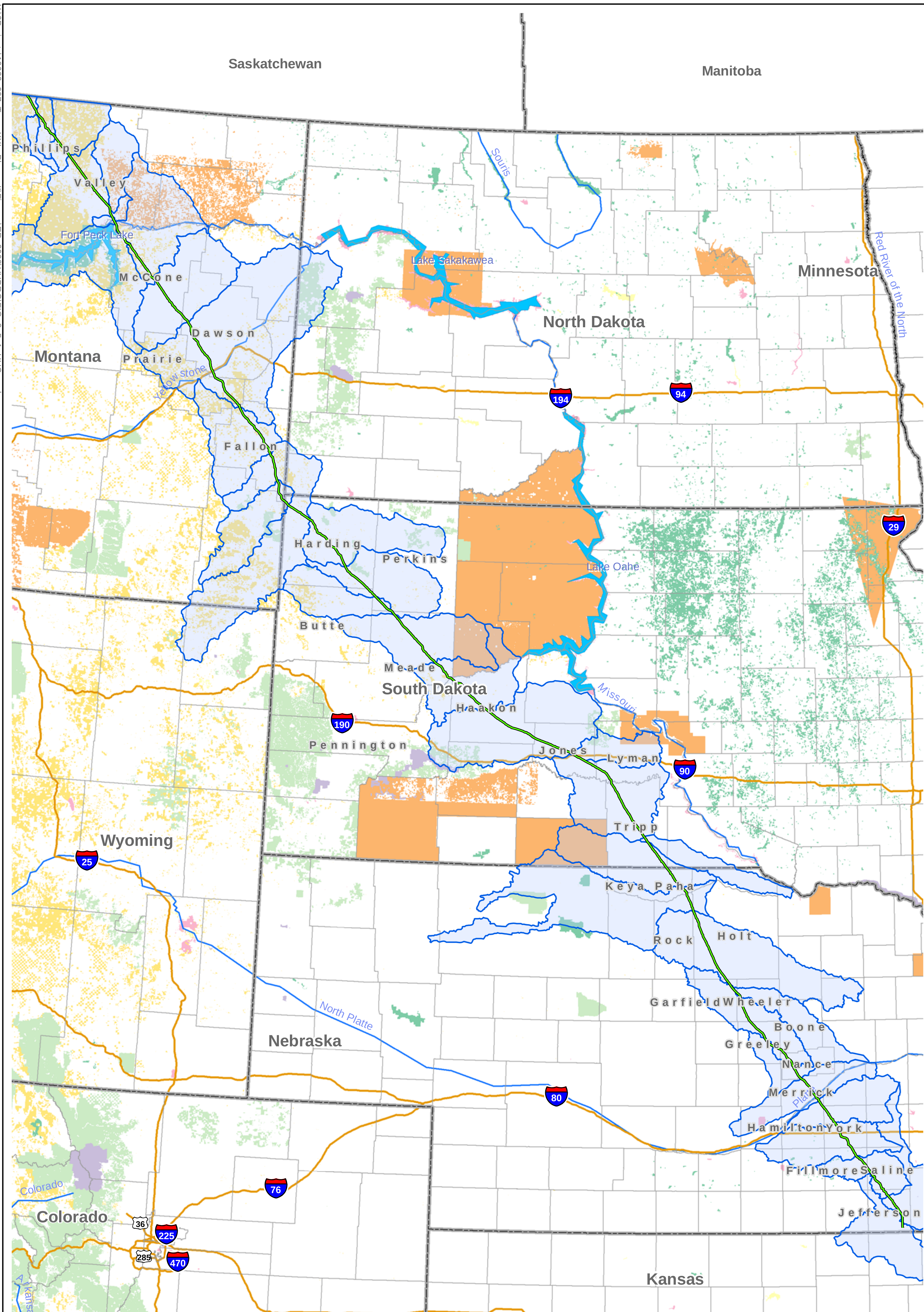
3.5.3 Groundwater

Existing literature on the geology and groundwater hydrogeology of the states and counties affected by the Project was reviewed, with particular emphasis on the location of shallow aquifers (i.e. those with a depth of less than 200 feet), depth to the shallow groundwater table, and expected use of the shallow aquifers within 10

miles of the route. These locations include areas where estimates of the depth to the water table are based on regional groundwater elevation contours, and where water quality estimates are a general estimate of water quality based on regional or sometimes county-wide evaluations. Generally, areas where aquifers are heavily used or are potentially sensitive to contamination, including shallow alluvial aquifers along major river drainages where the river alluvium is a major source of domestic and irrigation water supply, have more complete and available information that was used in this assessment.

The proposed Project lies within the Great Plains, Central Lowlands, and Gulf Coast physiographic provinces (Thornbury 1965). Portions of the Project in Montana and South Dakota are in the Great Plains province, the route and facilities in Nebraska, Kansas, and Oklahoma is in the Central Lowlands province, and the route in Texas is in the Gulf Coast physiographic province. Continental glaciation during the Pleistocene covered parts of the Great Plains and most of the Central Lowlands provinces with a complex array of glacial drift and glacial outwash. This glacial material covers the bedrock aquifers in many areas and provides shallow alluvial groundwater for domestic and agricultural use in both current stream valleys and also from buried glacial paleochannels. In many cases, the buried paleochannels are not continuous and serve as major sources of groundwater for local use. In many areas of the Great Plains, the glacial drift is fine-grained and relatively impermeable, thus it acts as a “confining layer” above the bedrock aquifers. Within this fine grained drift, local paleochannels can be found which can provide groundwater for ranches and small communities.

The following discussion presents groundwater resources by state and by each county crossed within that state. Locations where the proposed pipeline will either cross or be within 10 miles of a sensitive groundwater resource are indicated by milepost. Sensitive groundwater resources are defined as those shallow groundwater areas that occur in permeable rock units or unconsolidated alluvium, or where the groundwater is used for domestic or irrigation purposes.



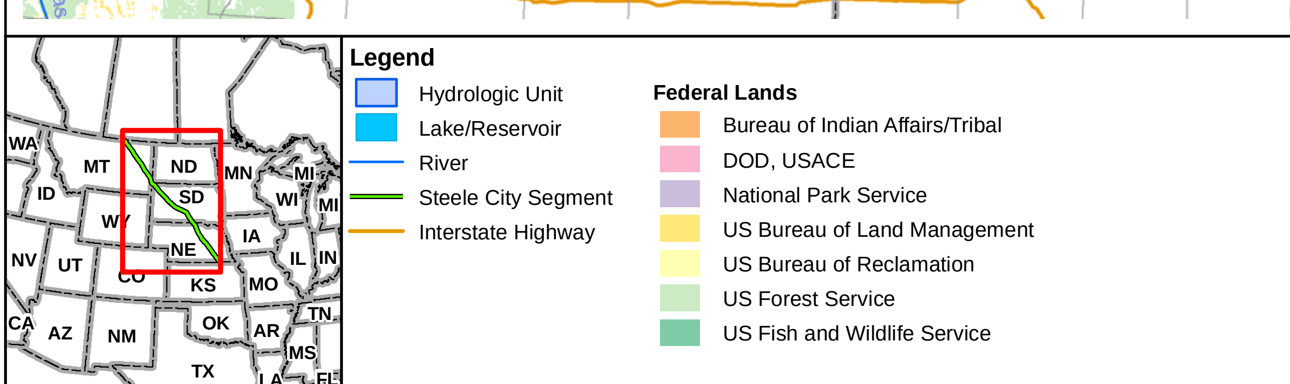


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Figure 3.5-1

Hydrologic Units
Steele City Segment

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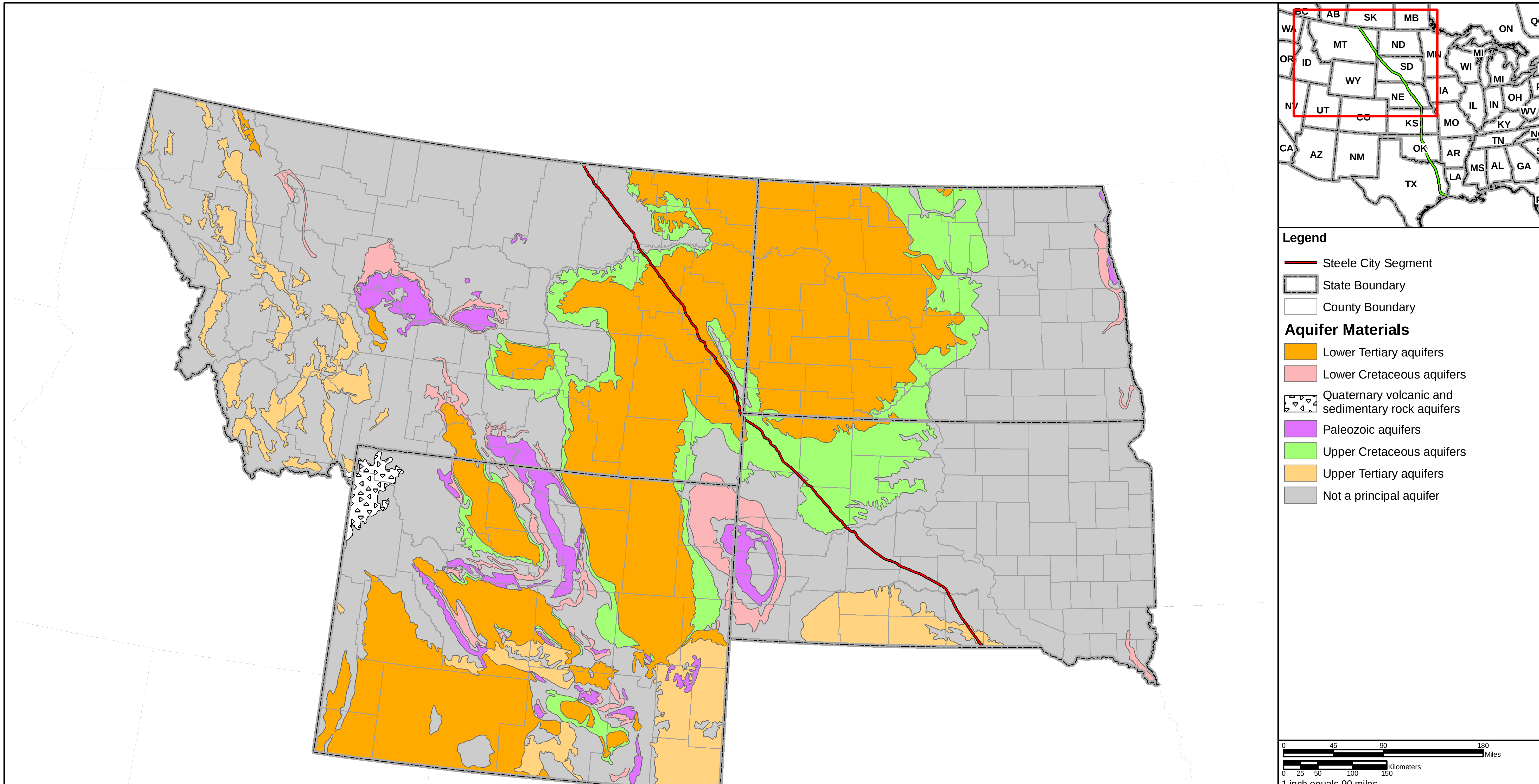
Table 3.5-3 Crossing Locations within 10 Stream Miles of USEPA Tier 1 or Tier 2 Sediment Sampling Sites

Surface Waterbody Associated with Sampling Site [1]	County	State	Waterbody Crossing Closest to Sampling Site (MP) [2]	USEPA Sediment Quality Category
Steele City Segment				
Niobrara River	Rock/Keha Paha	NE	613.7	2
Lake Ericson	Wheeler	NE	695.3	3
Loup River	Nance	NE	738.6	3
West Fork Big Blue River	York	NE	787.9	2, 3
Gulf Coast Segment				
Salt Creek	Lincoln	OK	9.1	2
North Canadian River	Seminole	OK	37.5	1
Little River	Seminole	OK	69.4	3
Canadian River	Hughes	OK	75.0	3
Canadian River	Hughes	OK	*75.0*	*1*
Muddy Boggy Creek	Coal	OK	110.7	2
Clear Boggy Creek	Atoka	OK	124.7	2
Atoka Reservoir	Atoka	OK	114.1	3
Atoka Reservoir	Atoka	OK	114.2	3
Big Sandy Creek	Upshur	TX	258.6	3
Lake Tyler	Smith	TX	281.6	2
Lake Tyler	Smith	TX	283.4	2
Hurricane River	Angelina	TX	356.0	2
Neches River	Angelina	TX	365.7	1
Neches River	Polk	TX	365.7	2
Trinity River	Liberty	TX	413.2	3
Green Pond Gully	Jefferson	TX	463.1	1
Neches River	Jefferson	TX	465.9	2
Neches River	Orange	TX	474.1	2
Neches River	Jefferson	TX	474.1	1
Neches River	Jefferson	TX	474.1	1
Neches River	Jefferson	TX	474.1	1
Willow Marsh Bayou	Jefferson	TX	474.8	2
Willow Marsh Bayou	Jefferson	TX	474.8	2
Taylor Bayou	Jefferson	TX	475.6	2
Neches River	Jefferson	TX	478.2	1
Neches River	Jefferson	TX	478.2	2
Neches River	Jefferson	TX	478.2	2
Neches River	Jefferson	TX	478.2	2
Neches River	Jefferson	TX	478.2	2
Neches River	Jefferson	TX	478.2	2
Neches River	Orange	TX	478.2	2

Table 3.5-3 Crossing Locations within 10 Stream Miles of USEPA Tier 1 or Tier 2 Sediment Sampling Sites

Surface Waterbody Associated with Sampling Site [1]	County	State	Waterbody Crossing Closest to Sampling Site (MP) [2]	USEPA Sediment Quality Category
Sabine Lake	Orange	TX	478.2	2
Houston Lateral				
Wallisville Lake	Chambers	TX	26.6	2
Cedar Bayou	Chambers	TX	33.2	2
Cedar Bayou	Chambers	TX	33.2	3
Busch Island	Harris	TX	38.8	1
Busch Island	Harris	TX	38.6	2
Busch Island	Harris	TX	44.4	2
Galveston Bay	Harris	TX	38.2	2
Galveston Bay	Harris	TX	44.4	2
Galveston Bay	Harris	TX	44.4	2
Galveston Bay	Harris	TX	44.4	1
Galveston Bay	Harris	TX	44.4	1
San Jacinto River	Harris	TX	44.1	2
San Jacinto River	Harris	TX	40.7	3
San Jacinto River	Harris	TX	43.9	2
Buffalo Bayou	Harris	TX	44.7	1
Buffalo Bayou	Harris	TX	47.0	2
Buffalo Bayou	Harris	TX	47.2	1
Buffalo Bayou	Harris	TX	47.2	1
Buffalo Bayou	Harris	TX	47.0	1
Buffalo Bayou	Harris	TX	47.0	1
Buffalo Bayou	Harris	TX	44.7	2
Buffalo Bayou	Harris	TX	47.0	2
Buffalo Bayou	Harris	TX	44.7	2
Greens Bayou	Harris	TX	47.0	1
Greens Bayou	Harris	TX	47.0	2
Lost Lake	Harris	TX	44.4	2
Lost Lake	Harris	TX	44.4	2
Lost Lake	Harris	TX	43.9	2
Galveston Bay	Harris	TX	44.4	2
Trinity River	Harris	TX	18.3	2

[1] Waterbody associated with the sediment sampling location. Waterbody may not be directly impacted by the proposed Project.
[2] The approximate waterbody crossing point that might lead to the USEPA Tier 1 or Tier 2 sampling site. The waterbody, which is crossed by the Project, may be a tributary to the waterbody associated with the sampling site. Refer to Appendix E for names and classifications of the crossed waterbodies.



Source: USGS Hydrologic Atlas HA-730-I, Figure 7

Modified from:
Ross, C.P., Andrews, DI.A., and Witkind, I.J., 1955, Geologic map of Montana
King, P.B., and Beikman, H.M., 1974 Geologic map of the United States.
Bluemie, J.P., 1982, Bedrock geologic map of North Dakota.
Love, J.D., and Christiansen, A.C., 1985, Geologic map of Wyoming.

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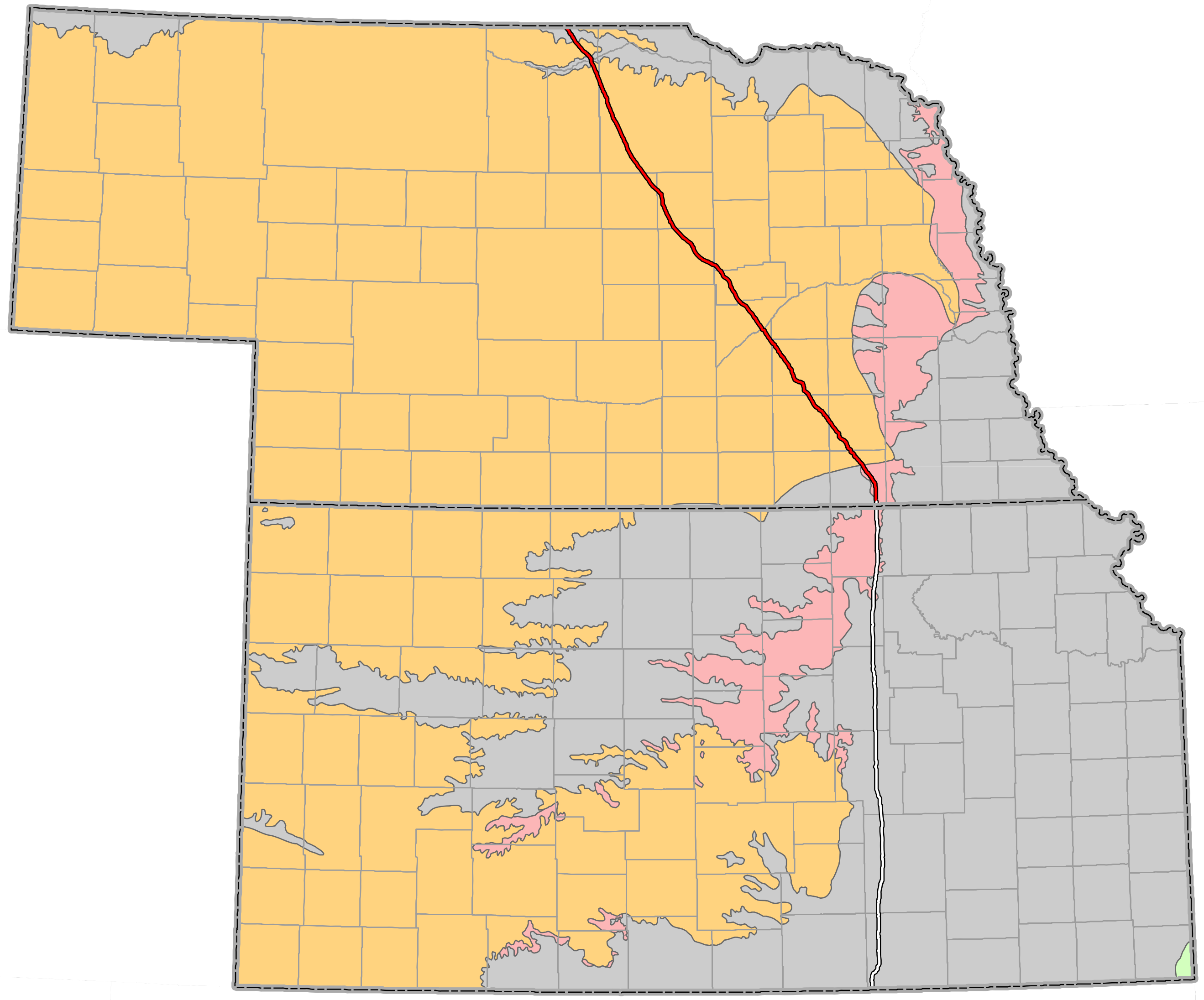
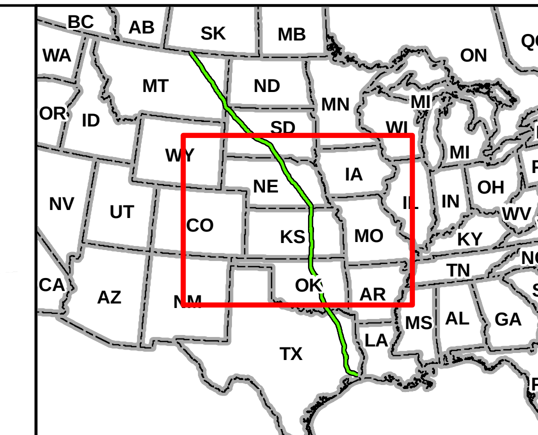
Figure 3.5-2

Aquifer Systems
Montana, Wyoming, South Dakota, and North Dakota





Legend

- DtlStates_NE_KS
- MaskFor_NE_KS
- MaskFor_NE_KS_MO
- Steele City Segment
- Keystone Cushing Extension
- State Boundary
- County Boundary

Aquifer Materials

- Ozark Plateaus aquifer system
- Lower Cretaceous aquifers
- Upper Tertiary aquifers
- No principal aquifers

0 37.5 75 150 Miles
0 25 50 100 150 Kilometers
1 inch equals 75 miles
N

Source: USGS Hydrologic Atlas HA-730-D, Figure 5

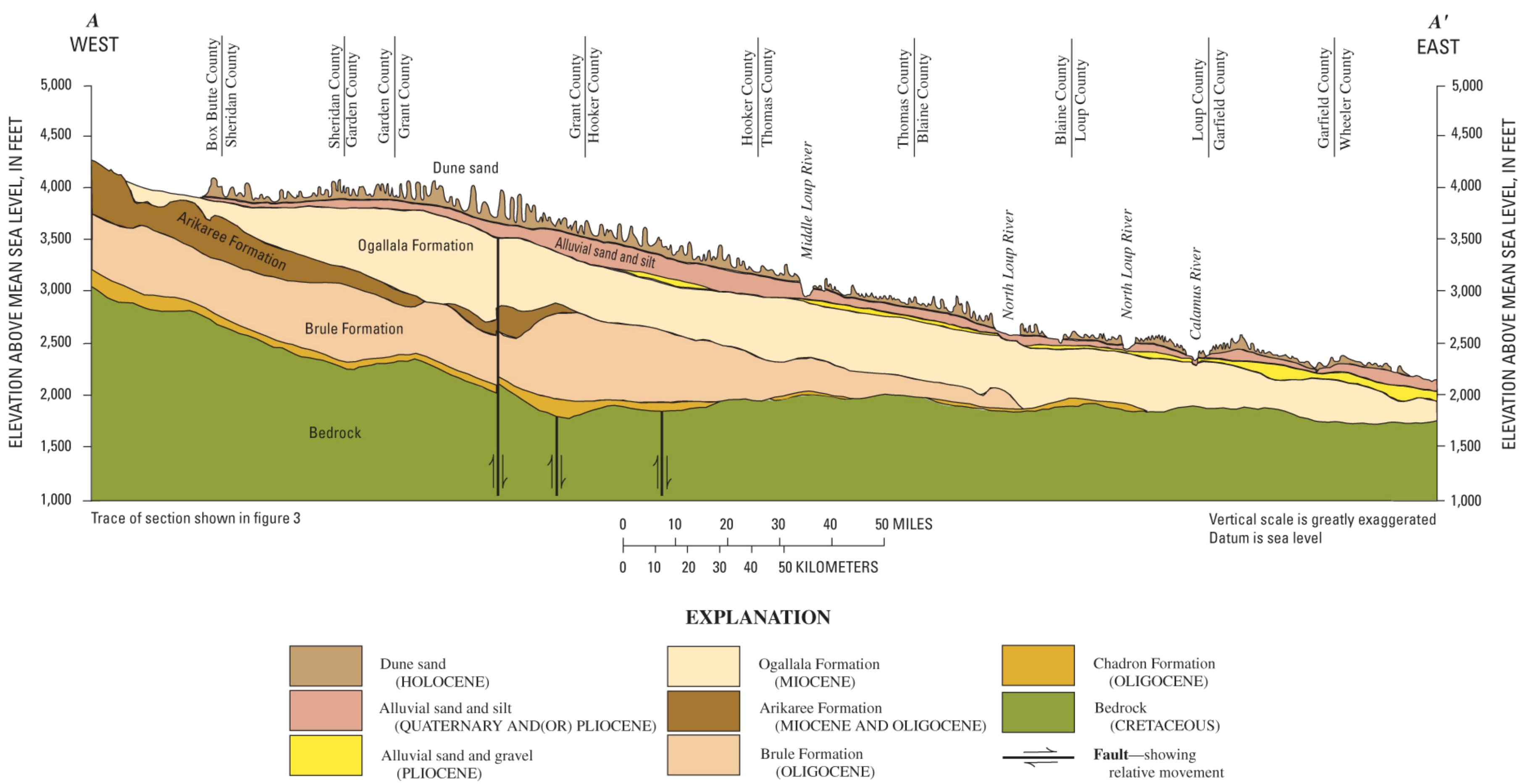
Modified from:
Kansas Geological Survey, 1964, Geologic map of Kansas.
Missouri Geological Survey, 1979, Geologic map of Missouri.
Burchett, R.R., comp., 1986, Bedrock geologic map of Nebraska.
Jorgensen, D.G., Helgesen, J.O., and Imes, J.L., 1993, Regional aquifers in Kansas, Nebraska, and parts of Arkansas, Colorado, Missouri, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming - Geohydrologic frameworok.
Imes, J.L., and Emmett, L.F., 1994, Geohydrology of the Ozark Plateaus aquifer system in parts of Missouri, Arkansas, Oklahoma, and Kansas.

TransCanada
Keystone XL Project

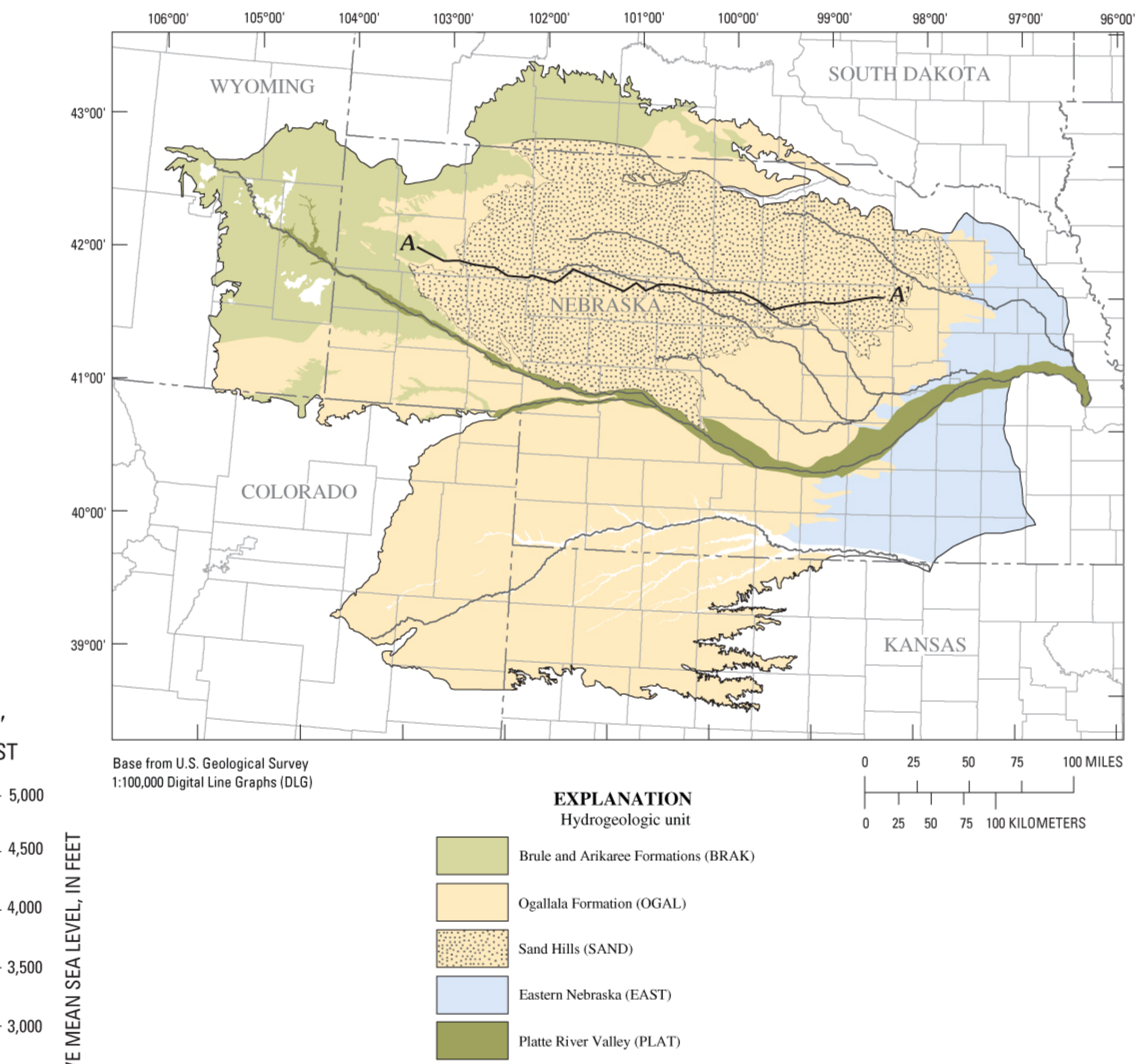
Figure 3.5-3

Aquifer Systems
Nebraska and Kansas

Source: USGS Scientific Investigation Report
SIR 2006-5138, Figure 4



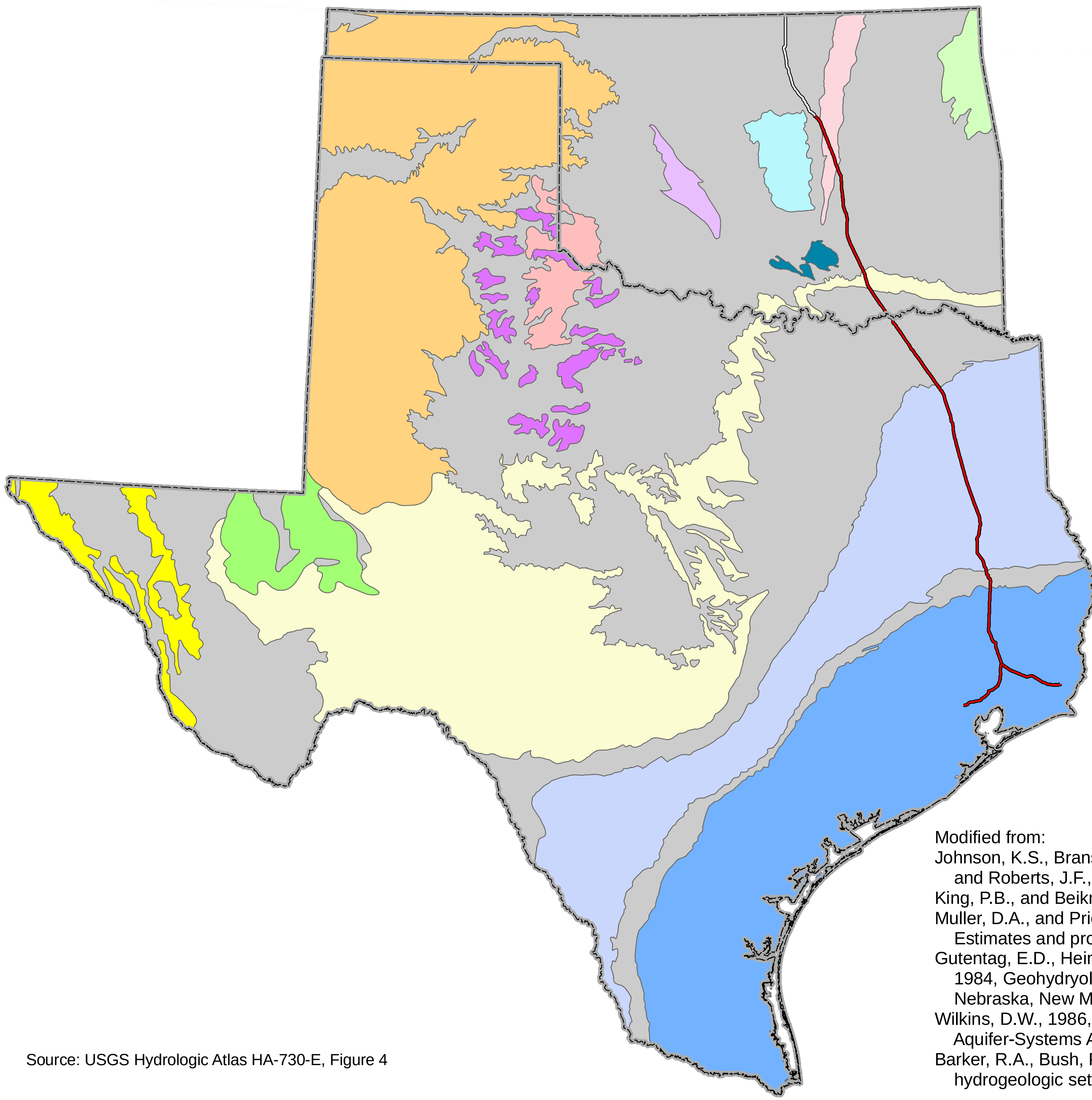
Geologic section *A–A′* in the High Plains aquifer and underlying bedrock (from Bleed and Flowerday, 1989).



Source: USGS Scientific Investigation Report
SIR 2006-5138, Figure 3

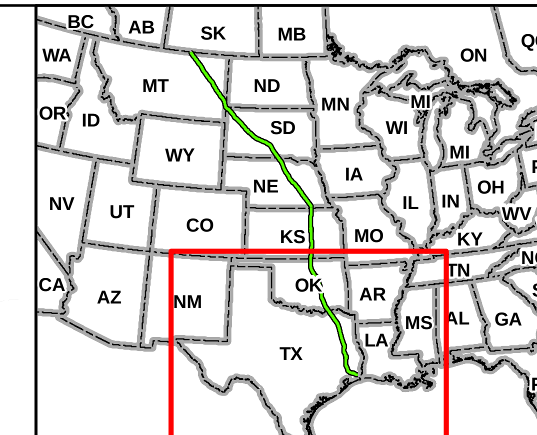
TransCanada Keystone XL
Steele City Segment

Figure 3.5-4
Generalized Geology and Geologic Cross-section A-A′ in the High Plains Aquifer and Underlying Bedrock



Source: USGS Hydrologic Atlas HA-730-E, Figure 4

Modified from:
Johnson, K.S., Branson, C.C., Crutis, N.M., Jr., Ham, W.E., Marcher, M.V., and Roberts, J.F., 1972, Geology and earth resources of Oklahoma.
King, P.B., and Beikman, 1974, Geologic map of the United States.
Muller, D.A., and Price, R.D., 1979, Ground-water availability in Texas - Estimates and projections through 2030.
Gutentag, E.D., Heimes, F.J., Krother, N.C., Luckey, R.R., and Weeks, J.B., 1984, Geohydryology of the High Plains aquifer in parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Qyoming.
Wilkins, D.W., 1986, Geohydrology of the southwest alluvial basins Regional Aquifer-Systems Analysis, Parts of Colorado, New Mexico, and Texas.
Barker, R.A., Bush, P.W., and Baker, E.T., Jr., 1994, Geologic history and hydrogeologic setting of the Edwards-Trinity aquifer system, west-central Texas.



Legend

- Gulf Coast Segment
- Keystone Cushing Extension

Aquifer Materials

- Seymour aquifer
- Rio Grande aquifer system
- Rush Springs aquifer
- Pecos River Basin alluvial aquifer
- Trans-coastal lowlands aquifer system
- Ada-Vamoosa aquifer
- Central Oklahoma aquifer
- Arbuckle-Simpson aquifer
- Blaine aquifer
- Edwards-Trinity aquifer system
- Texas coastal uplands aquifer system
- Ozark Plateaus aquifer system
- Upper Tertiary aquifers
- No principal aquifers

0 45 90 180 Miles
0 25 50 100 150 Kilometers
1 inch equals 90 miles

N

TransCanada
Keystone XL Project

Figure 3.5-5

Aquifer Systems
Oklahoma and Texas

3.5.3.2 Steele City Segment - Montana

The Project route passes through six counties in eastern Montana within the Great Plains physiographic province (Thornbury 1965), and is underlain by the Northern Great Plains aquifer system (Whitehead 1996). The two northernmost counties, Phillips and Valley, were glaciated during the Pleistocene, and thus have a thick veneer of glacial till. Three main aquifer types are found along the Project in eastern Montana: (1) unconsolidated alluvial and/or glacial aquifers; (2) lower Tertiary aquifers, mainly in the Fort Union Formation; and (3) upper Cretaceous aquifers, mainly in the Fox Hills and Hell Creek Formations. The most sensitive aquifers are the shallow alluvial aquifers found in unconsolidated alluvial and glacial sediments along major drainages (Milk, Missouri, and Yellowstone Rivers) crossed by the proposed Project.

Phillips County

Phillips County is covered by a veneer of glacial till and drift, which is generally 20 to 40 feet thick, but can reach 100 feet (Whitehead 1996). This glacial till overlies the upper Cretaceous Judith River and Clagett Formations. The glacial till is relatively impermeable and acts as a “confining layer” above the upper Cretaceous bedrock aquifer found mainly in the Judith River Formation. The glacial till can contain locally permeable buried zones of coarse glacial outwash which may provide water for ranches.

The upper Cretaceous Judith River Formation is the main aquifer and consists of sandstone and siltstone. The aquifer is confined, and the water table elevation ranges from 2,600 to 2,800 feet amsl (Libmeyer 1985). Groundwater quality ranges from Montana class II with a total dissolved solids (TDS) content between 500 and 1,800 mg/L, to Montana class III with a TDS between 1,800 and 10,000 mg/L. The water table is from 150 to 500 feet deep based on drilling depths for recorded water wells (Smith et al. 2000). There are 5 to 10 wells per 1,000 square miles and well yields are in the range of 5 to 20 gallons per minute (gpm) (Whitehead 1996).

The proposed Project in Phillips County follows Cottonwood Creek and Corral Coulee across the rolling plains of sparsely populated eastern Montana. From approximately MP 20 to MP 25, the proposed route will pass within 5 to 7 miles of mapped springs north of Frenchman Creek and Reservoir. From MP 25 to MP 27, the proposed route crosses Frenchman Creek just upgradient from Frenchman Reservoir. The area consists of a mix of coarse glacial outwash and permeable alluvial material, has a groundwater table at less than 50 feet below the surface, and is a highly sensitive aquifer area by Montana standards (Smith et al. 2000).

Valley County

Valley County, like Phillips County, once was glaciated and is covered by a veneer of glacial till up to 100 feet in thickness. This glacial till overlies the upper Cretaceous Judith River Formation in the northwest part of the county near the boundary with Phillips County, but over most of the county, the till lies above the impermeable upper Cretaceous Bearpaw Shale. Valley County has less than 5 wells per 1,000 square miles (Whitehead 1996) and well yields are low. Water elevations in the Judith River Formation are in the range of 2,600 to 2,800 feet amsl (Libmeyer 1985). Water quality in the upper Cretaceous rocks has a TDS around 2,000 mg/L (Downey and Dinwiddie 1988) and is mostly dominated by sodium chloride (LaRicque 1966), making it Montana class III water.

Most groundwater used in Valley County comes from shallow alluvial aquifers along major drainages. The two main rivers in Valley County encountered by the proposed route are the Milk River and the Missouri River. Groundwater in the alluvium of the Milk River exists at depths of less than 100 feet below ground surface (bgs) in a mixture of coarse glacial outwash and river alluvium which is up to 400 feet thick. This alluvial material is a major source of water (Whitehead 1996). The many wells in the alluvium along the Missouri River yield 100 to 500 gpm. The shallow alluvial water table is less than 50 feet bgs deep (LaRique 1966), and the alluvium along the river in the area of the proposed Project crossing is 30 to 150 feet thick. The TDS ranges from 800 to 2,700 mg/L (Swenson and Drum 1955), consistent with a Montana class II or class III water.

A number of drainages in Valley County are considered sensitive groundwater resources. From MP 39 to MP 41, the proposed route will cross Rock Creek, considered sensitive due to the shallow alluvial aquifer in the crossing area. From MP 47 to MP 50, the proposed line will pass within 5 miles of mapped springs. From MP 55 to MP 56, the proposed line will cross Buggs Creek, which could be a sensitive groundwater resource, depending on the depth to groundwater. The same will be true for Cherry Creek, crossed at MP 66 to MP 71. Starting with MP 82 and extending to MP 85, the route will cross the Milk River, which is a highly sensitive groundwater resource in Montana, as described in the previous paragraph, and the proposed route will cross the Missouri River from MP 19 to MP 90, passing near a mapped well. The shallow alluvial aquifer in the alluvium of the Missouri River is a highly sensitive groundwater resource in Montana because of the shallow depth to groundwater (less than 50 feet) and the considerable use of the groundwater.

McCone County

The Project crosses two aquifers in McCone County, the upper Cretaceous Hells Creek/Fox Hills aquifer and the lower Tertiary Fort Union aquifer. Approximately one-third of the proposed route in McCone County is in the Hells Creek/Fox Hills outcrop area beginning south of the Missouri River in the dissected uplands. The remainder of the proposed route within McCone County is within the rolling upland plains underlain by the lower Tertiary aquifer.

The upper Cretaceous Hells Creek/Fox Hills aquifer has groundwater elevations in the range of 2,200 to 2,400 feet amsl (Whitehead 1996), with a TDS ranging from 500 to 1,800 mg/L dominated by sodium bicarbonate. The permeable sandstones of the lower one-third of the Hells Creek/Fox Hills aquifer contain a confined aquifer overlain by less permeable mudstones. Yields in the permeable sandstones of the Hells Creek/Fox Hills are in the range of 5 to 20 gpm and most wells are drilled to depths of 150 to 500 feet. Groundwater flows northeast and is part of regional flow in the northwestern flank of the Williston Basin.

The lower Tertiary Fort Union aquifer consists of interbedded sandstones, mudstones, shale, and coal seams. Groundwater elevations in the Fort Union aquifer in McCone County are in the range of 2,400 feet amsl in the northern part of the county to 2,800 feet amsl in the southeastern part of the county. Groundwater flow is to the northwest toward the Missouri River. The Fort Union aquifer is mostly a confined aquifer that is found in sandstones interbedded with shales and mudstones. Drilling depths for most wells are in the range of 50 to 300 feet (Libmeyer 1985), and well yields are 15 to 25 gpm. Water quality is highly variable with TDS ranging from 500 to as much as 5,000 mg/L, and sodium bicarbonate is the primary constituent (Busbey et al. 1995). Water depths in the Fort Union aquifer range from 100 to 150 feet bgs (Swenson and Drum 1955). Groundwater flow in the lower Tertiary Fort Union aquifer is mostly to local drainages from highland recharge areas.

Between MP 91 and MP 110, the proposed pipeline route crosses dissected uplands underlain by the upper Cretaceous Hells Creek/Fox Hills aquifer system. From MP 93 to MP 98 within this system, the route passes within 2 miles of the Bear Creek recreational area, which is fed by ephemeral drainages crossed by the proposed route. At approximately MP 105, the proposed route enters Bear Creek, and groundwater in the alluvium of this creek also could flow into the Bear Creek recreational area. From MP 100 to the Dawson County line (approximately MP 156), the proposed route passes through rolling plains underlain by the lower Tertiary Fort Union aquifer and will be within five miles of mapped ranch wells or mapped springs. From MP 143 to MP 145 the proposed route is within Lone Creek, and from MP 145 to MP 148 the proposed route is within 2 miles of Circle, Montana. Groundwater is the main source of water for a small community like Circle. The wells near Circle will be the most sensitive groundwater area passed in this county. However, the proposed route in McCone County does not cross any streams or areas considered to have highly sensitive groundwater.

Dawson, Prairie, and Fallon Counties

Dawson, Prairie, and Fallon Counties are part of the Lower Yellowstone aquifer system with groundwater resources in the lower Tertiary Fort Union Formation, linked to the lower Yellowstone River system. In parts of

Fallon County, the upper Cretaceous Fox Hills and Hells Creek formations are exposed in the Cedar Ridge anticline, however, the proposed pipeline route will not go through the Cedar Ridge anticline area.

The Fort Union Formation is a shallow bedrock aquifer and provides most of the groundwater used in all three counties. Major streams in the area, such as the Yellowstone, have considerable alluvial material along their banks and in terraces which contain important shallow aquifers which are used for water supply. The upper Cretaceous Fox Hills and Hells Creek formations underlie the lower Tertiary Fort Union at depths from 600 to 1,600 feet bgs. Groundwater flow in the Fox Hills and Hells Creek formations is confined and part of a regional flow system that directs groundwater flow to the lower Yellowstone River. Groundwater flow in the Fort Union Formation includes both local flow from higher topographic areas to local drainages and a general regional flow to the Yellowstone River.

Groundwater elevations in the lower Tertiary Fort Union aquifer range from 2,600 to 3,000 feet amsl. The Yellowstone River acts as a regional drain for groundwater in the Fort Union aquifer because a groundwater low area exists along the course of the river. Groundwater elevations in the underlying upper Cretaceous Fox Hills/Hells Creek aquifer range from 2,200 to 2,800 feet amsl. Groundwater levels in the alluvial aquifers adjacent to the lower Yellowstone River are in the range of 2,000 to 2,200 feet amsl (Smith 1998).

Well yields and groundwater quality vary depending on the aquifer and the depth of the well. Well yields in the shallow alluvial aquifers adjacent to the Yellowstone River range from 50 to 500 gpm (LaRique 1966). Water quality is similar to river water quality, consisting of calcium bicarbonate water with TDS ranges from 1,000 to 1,500 mg/L. Wells in the Fort Union aquifer yield an average of 10 gpm, and water is dominated by sodium bicarbonate, with a TDS range of 500 to 5,000 mg/L. Average TDS is about 1,670 mg/L (Smith et al. 2000). Wells in the Fox Hills aquifer usually yield below 15 gpm (Smith et al. 2000). Like water in the Fort Union aquifer, water in the Fox Hills aquifer also is sodium bicarbonate dominated, but the TDS ranges from 1,000 to 2,500 mg/L, averaging about 1,460 mg/L (Smith et al. 2000). About 60 percent of all wells in these three counties are less than 200 feet deep (Smith 1998), and the maximum well depth is around 400 feet (Smith et al. 2000).

Aquifer properties have been measured in the lower Yellowstone River system (Smith et al. 2000). Shallow alluvial aquifers have a hydraulic conductivity around 75 feet per day with a transmissivity that ranges from 3,600 to 5,800 gallons per day per foot. Slug tests in the Fort Union aquifer gave estimates of hydraulic conductivity in the range of 0.01 to 0.6 feet per day. For the Hells Creek aquifer, transmissivities range from 300 to 3,000 gallons per day per foot. Groundwater in wells less than 100 feet in depth has high tritium values, suggesting recent recharge from precipitation (Smith et al. 2000). Groundwater in deeper wells and especially in the Fox Hills/Hells Creek aquifer has low tritium values and probably has not been recharged in the past 40 to 50 years.

The proposed route through these three counties crosses a few streams with shallow alluvial aquifers which could be considered sensitive groundwater areas. Between MP 174 and MP SC 178, the proposed route encounters Clear Creek and crosses the potentially sensitive alluvial aquifer of this ephemeral stream. Similarly, from MP 187 to MP 188, the route encounters Cracker Box/Timber Creek. From MP 194 to MP 197, the proposed route crosses the lower Yellowstone River, where the alluvial groundwater table is less than 50 feet bgs and the groundwater aquifer is a highly sensitive groundwater area in Montana because of the shallow groundwater table, the permeable unconsolidated alluvial material, and the use of the groundwater (Smith et al. 2000). From MP 202 to MP SC 203, the route encounters Cabin Creek and the alluvium associated with this creek. At MP 215, the route passes a flowing well within 2 miles of the proposed route. At MP 229, the proposed route passes within 1 mile of a mapped well. From MP 244 to MP 245, the proposed route crosses Sandstone Creek within 2 miles of Baker, Montana. Groundwater from both the Fort Union and the Fox Hills aquifers is used for public water supply at Baker. Also, the alluvium of Sandstone Creek contains a shallow aquifer. At MP 246, the proposed route crosses Butte Creek. In Dawson, Prairie, and Fallon Counties, the crossings at the Yellowstone River and Sandstone Creek are the most sensitive groundwater areas. Crossing the alluvial plains of ephemeral creeks may also involve shallow alluvial aquifers that have water during the spring but may be mostly dry during the late summer and fall.

3.5.3.3 Steele City Segment - South Dakota

The proposed Project crosses six counties and two main aquifer systems in South Dakota (Figure 3.5-2). South Dakota lies within the Great Plains physiographic province (Thornbury 1965), and is mostly underlain by the Northern Great Plains aquifer system (Whitehead 1996). The proposed pipeline will cross the upper Cretaceous part of the Northern Great Plains aquifer system in Harding, Perkins, and Meade Counties in South Dakota. The proposed route crosses the Cheyenne River, between Meade and Haakon Counties, entering an area underlain by the impermeable upper Cretaceous Pierre Shale. Pierre Shale also underlies the proposed pipeline route in Jones County. In Tripp County, the proposed pipeline route will enter the northernmost part of the High Plains aquifer system, which is underlain by upper Tertiary aquifers (Whitehead 1996). The proposed route in South Dakota will cross the Little Missouri River, the Moreau River, the Cheyenne River, the Bad River, and the White River. Each of these major rivers has alluvium associated with the river channel and terraces composed of Pleistocene alluvial material that may contain water and be a local source of domestic or agricultural water.

The proposed route will cross the upper Cretaceous Fox Hills and Hell Creek aquifers from Harding to Meade Counties, and the Tertiary Ogallala, Arikaree, and White River aquifers in Tripp County. Because it is relatively impermeable, the Pierre Shale, which separates the upper Cretaceous from the lower Cretaceous, does not constitute an aquifer in South Dakota. Water quality in the upper Cretaceous aquifers has a TDS in the range of 1,000 to 3,000 mg/L, and the water is mostly dominated by sodium bicarbonate. In South Dakota, groundwater with a TDS below 10,000 mg/L is considered suitable for beneficial use (South Dakota Administrative Rules 2007), and degradation of groundwater is not permitted. Groundwater in the Tertiary aquifers generally has a TDS below 1,500 mg/L, while the TDS in river alluvium and Pleistocene river terrace groundwater can vary from 100 to 4,000 mg/L (Hammond 1994). Depth to groundwater ranges up to 800 feet in the upper Cretaceous aquifers and is often less than 50 feet in the Tertiary aquifers. Depth to groundwater in the river alluvium and the Pleistocene terraces can be from a few feet to around 150 feet.

Areas where groundwater in the river alluvium and Pleistocene terraces of western South Dakota is used for domestic, agricultural, and municipal purposes have been studied in some detail. Wells along Battle Creek and Grizzly Creek near Keystone, South Dakota, are 60 to 125 feet in depth with yields of 75 to 100 gpm. The water is calcium bicarbonate dominated with a TDS of 200 to 400 mg/L (Bretz and Barari 1996). Wells in the alluvium along the Bad River have a TDS of 300 to 2,100 mg/L driven by calcium sulfate (Dalsin and Barari 1980). Along the Little White River, the alluvium has a TDS of 25 to 4,000 mg/L and the water is mostly sodium bicarbonate water (Cripe and Barari 1978). The alluvium along the White River produces sodium bicarbonate-dominated groundwater with a TDS in the range of 287 to 688 mg/L. TDS in the Pleistocene terraces varies from 30 to 4,000 mg/L, with depths to water of 10 to 70 feet (Hammond 1994).

<u>Harding, Perkins, and Meade Counties</u>

Harding, Perkins, and Meade Counties are underlain by the upper Cretaceous Fox Hills and Hell Creek aquifers. The Fox Hills Formation consists of deltaic and interdeltaic sandstones, siltstones, and shales that are approximately 300 feet thick (Whitehead 1996). The Hell Creek Formation is primarily a fluvial sandstone with interbedded siltstones and carbonaceous claystones, and can range from 350 feet to 1,500 feet thick. Groundwater elevations in the upper Cretaceous aquifers range from approximately 3,000 feet amsl in Harding County to 2,600 feet amsl in Perkins County, and from 2,400 to 2,200 feet amsl in Meade County. Water quality in the upper Cretaceous aquifers generally has a TDS around 1,000 mg/L, but can reach 3,000 mg/L near the Cheyenne River in southern Meade County (Whitehead 1996). The groundwater is sodium calcium bicarbonate dominated with locally high sulfate, especially near the Cheyenne River. Yields to wells range from 5 to 50 gpm, and most wells are less than 800 feet deep. The town of Bison gets municipal water from the Fox Hills aquifer. The municipal wells are 565 to 867 feet deep with a TDS between 300 and 1,900 mg/L (Steece 1981).

In Harding County, the proposed route crosses a relatively flat plain with abundant ephemeral shallow drainages. Between MP 291 and MP 293, the proposed route crosses the Little Missouri River. The Little

Missouri River has a meandering floodplain, and alluvial groundwater may be present at shallow depths. Between MP 316 and MP 318, the route passes within 3 miles of Buffalo, South Dakota. The proposed route crosses the South Fork of the Grand River between MP 318 and MP 319. Water supply for Buffalo is from the upper Cretaceous Fox Hills Formation in the bedrock, and from the alluvium of the Grand River. The route crosses the floodplain of Clarks Fork Creek between MP 323 and MP 324, and crosses the floodplain of Squaw Creek between MP 328 and MP 329. Clarks Fork Creek can be expected to have shallow alluvial water in its floodplain. Near MP 339, the route comes within Hauk Springs. The proposed route crosses the floodplain of the Moreau River between MP 354 and MP 357 in the northeastern corner of Butte County.

The proposed pipeline route enters dissected uplands underlain by the upper Cretaceous Fox Hills and Hell Creek aquifers at MP 358 in Perkins County. The floodplain of the South Fork of the Moreau River is between MP 364 and MP 365 and the proposed pipeline continues through dissected uplands in Meade County. From MP 399 to MP 400, the Project will cross Sulphur Creek floodplain, and will cross the broad floodplain of Red Owl Creek between MP 407 and MP 409. Both of these floodplains have the potential for shallow alluvial groundwater. At approximately MP 418, the route enters the deeply dissected terrain bordering the Cheyenne River, crossing the floodplain between MP 425 and MP 426. This area has shallow alluvial groundwater that may be within 50 feet or less of the surface.

Haakon, Jones, and Lyman Counties

Haakon, Jones, and Lyman Counties are underlain by the upper Cretaceous Pierre Shale, which is not an aquifer and does not supply water for domestic or municipal wells. Stock wells have low yields in this unit, producing sodium calcium bicarbonate water with a TDS averaging 1,720 mg/L and low yields (Carter 1998).

At approximately MP 426, the proposed route enters dissected uplands underlain by the Pierre Shale. Between MP 430 and MP 470, the route passes within a few miles of stock ponds created by local damming of ephemeral drainages. The floodplain of the Bad River (a source of water for the town of Midland) is between MP 480 and MP 481. The proposed route continues through the dissected plains underlain by the Pierre Shale to MP 525. From MP 525 to MP 535 the route follows a sloping plain to the White River. Between MP 535 and MP 536, the route crosses the floodplain of the White River, where the alluvial groundwater table is shallow and used for water supply.

Tripp County

Tripp County is underlain by the northern extension of the High Plains aquifer (Whitehead 1996) and contains both Tertiary aquifers and Pleistocene river terrace aquifers (Whitehead 1996). The Tertiary aquifers are the Ogallala, Arikaree, White River, and Fort Union (McGregor 1975); however, the Fort Union is not crossed by the proposed Project route. The Ogallala aquifer is crossed south of the White River, and is composed mainly of sandstone and claystone. It has two main members in South Dakota: the Ash Hollow and the Valentine formations. The Valentine is the main water-bearing unit (Whitehead 1996). Groundwater elevations are in the range of 2,700 to 2,800 feet amsl with the depth to water generally from 10 to 70 feet bgs (Hammond 1994), but potentially up to 150 feet (Carter 1998). The hydraulic conductivity ranges from 3 to 160 feet per day, averaging about 30 feet per day, and the transmissivity ranges from 800 to 9,200 feet squared per day, with an average around 2,800 feet squared per day (Carter 1998). The groundwater is sodium bicarbonate dominated with a TDS generally less than 500 mg/L (Whitehead 1996; Rich 2005). Well yields are in the range of 250 to 750 gpm. The Arikaree aquifer is similar to the Ogallala in hydraulic properties and well yields. The White River aquifer has limited water.

At approximately MP 537, the proposed route enters dissected uplands underlain by the upper Tertiary aquifers of the High Plains aquifer system. The route crosses the floodplain of Cottonwood Creek at MP 542. The terrain becomes less dissected at approximately MP 546, and the route passes within a few miles of stock ponds between MP 552 and MP 554. From MP 561 to MP 564, the route is less than 5 miles from Winner, South Dakota. This community obtains water from the shallow upper Tertiary aquifers at depths up to 100 feet bgs. From MP 564 to MP 566, the route crosses the floodplain formed by the intersection of Dog Ear Creek

and Mud Creek. From MP 567 to MP 593, the route crosses an upland underlain by the upper Tertiary aquifers. Approximately one mile from the South Dakota border with Nebraska (MP 594), the route enters the floodplain of Buffalo Creek.

3.5.3.4 Steele City Segment - Nebraska

The proposed Project will pass through 14 counties in east central Nebraska (Figure 3.5-2). In this region, the principal uppermost underlying the proposed pipeline route is the Northern High Plains aquifer (Gutentag et al. 1984; Miller and Appel 1997; Weeks et al. 1988). The Northern High Plains aquifer supplies 78 percent of the public water supply and 83 percent of the irrigation water supply in Nebraska (Emmons and Bowman 1999). The Project will parallel the Keystone Pipeline Project in Jefferson County in southeastern Nebraska. Five main members of the Northern High Plains aquifer will be transected by the Project, as shown in Figure 3.5-3. Four of these members are major sources of domestic, municipal, and irrigation water supply in eastern Nebraska, with the Ogallala and the Plate River Valley aquifers being the most significant. In addition, the proposed line will cross the Niobrara, the Elkhorn, the Loup, the Platte, and the Republican Rivers, all of which have alluvial aquifers that are sources of either public water supply or irrigation water.

The stratigraphically lowest members of the Northern High Plains aquifer are the Tertiary Brule and Arikaree formations. These formations are found in Keya Paha County, north of the Niobrara River, and are composed of siltstone and sandstone with interbedded volcanic ash, clays, and local gravels. These units total about 1,000 feet in thickness and are not a major source of groundwater because of their consolidated nature. The Tertiary Ogallala Formation lies above these two units, and covers most of central Nebraska (Figure 3.5-3). This unit consists of unconsolidated to partially consolidated sand, gravel, and silt deposited as broad alluvial sheets formed by coalescing braided streams. The Ogallala Formation has an average thickness of 200 to 400 feet, with a maximum thickness around 1,000 feet (Miller and Appel 1997) and thins from west to east across Nebraska, as shown in Figures 3.5-2, 3.5-3, and 3.5-4.

Above the Ogallala in north central Nebraska are the Sand Hills. This area consists of Quaternary loess, dune sand, and silt formed from the underlying Ogallala during a period of prolonged drought in the Midwest. These dune sands are up to 300 feet thick and very permeable. The lower parts of the Sand Hills member of the Northern High Plains aquifer can be saturated and act as part of the Ogallala aquifer. The very good water quality combined with the high susceptibility to contamination makes this member of the Northern High Plains aquifer sensitive to any form of surface spill or use of pesticides or herbicides.

The Quaternary to Recent Platte River Valley alluvial aquifer is a major source of public water supply and has a shallow depth to groundwater, making it a sensitive area for the Project. The Platte River Valley aquifer provides about 50 percent of the daily groundwater production in Nebraska and supplies water to Kearney, Grand Island, and Lincoln (Emmons and Bowman 1999). Southeast of the Platte River, the proposed pipeline route enters the Eastern Nebraska glacial drift and alluvial aquifer member of the Northern High Plains aquifer. This area is characterized by Quaternary unconsolidated glacial outwash and alluvial material derived from the reworking of the Pleistocene glacial material. These sediments have a considerable amount of silt and clay and thus are less permeable than the Ogallala Formation, but still are an important source of water supply for irrigation and municipalities.

Groundwater elevations in the Northern High Plains aquifer system of central Nebraska range from around 2,400 feet amsl in Keya Paha County near the Niobrara River to around 1,600 feet amsl in Polk County near the Platte River (Miller and Appel 1997). Groundwater generally flows from northwest to southeast across the state. The Platte River acts as a sink for groundwater in the Northern High Plains aquifer and receives about 50 to 90 percent of its flow from groundwater baseflow, depending on the season. Southeast of the Platte River, in Saline County, groundwater elevations range from 1,400 to 1,600 feet amsl. The saturated thickness of the Ogallala aquifer ranges from 10 to 200 feet in the northern part of Nebraska to more than 600 feet in central Nebraska beneath the Sand Hills (Miller and Appel 1997). The median depth to water in the Ogallala is around 110 feet, while the median depth to groundwater in the Sand Hills is only 20 feet. In the Platte River Valley, the median depth to groundwater in the river alluvium is only 5 feet. Southeast of the Platte River in the

Eastern Nebraska glacial drift aquifer, the median depth to groundwater is 79 feet (Stanton and Qi 2006). The average soil permeability ranges from a high of 12.4 inches per hour in the Sand Hills, to an average of 6.4 inches per hour for most of the Ogallala, to a low value of 1.4 inches per hour in the eastern Nebraska glacial drift material southeast of the Platte River. Along the Platte River, the river alluvium has an average permeability of 6.0 inches per hour (Stanton and Qi 2006).

The yield to wells from the Ogallala is generally greater than 750 gpm throughout eastern Nebraska (Miller and Appel 1997). Groundwater quality north of the Platte River generally has a TDS less than 500 mg/L. The water is usually dominated by calcium bicarbonate, but can have elevated sulfate and become calcium sulfate water along the Platte River. The average hydraulic conductivity of the Ogallala ranges from 25 to 100 feet per day (Gutentag et al. 1984). The Platte River Valley alluvial aquifer has an average thickness around 90 to 100 feet, a transmissivity that can range from 8,000 to 80,000 feet squared per day, and a well yield that ranges from 100 to 1,000 gpm with some wells having a yield as high as 2,500 gpm (Miller and Appel 1997). The Eastern Nebraska glacial drift aquifer ranges between 100 and 200 feet in thickness, has a transmissivity from 200 to 13,000 feet squared per day, and yields to wells up to 1,000 gpm. The water quality is dominated by calcium bicarbonate and the TDS is usually below 500 mg/L. In the Sand Hills, the water quality is good, with a TDS generally below 250 mg/L. Groundwater seeps in the Sand Hills can lead to the formation of small lakes in hollows that evapoconcentrate the water and become saline.

Keya Paha County

The proposed Project enters Nebraska in Keya Paha County. The proposed Project route crosses the Keya Paha River and the Niobrara River, transects the Tertiary Brule aquifer north of the Keya Paha River and the Ogallala aquifer south of the Keya Paha River. Pleistocene loess and unconsolidated alluvium are found along the major stream valleys and can be up to 325 feet thick (Newport and Krieger 1959). The Brule Formation siltstone can be up to 350 feet thick and generally does not yield appreciable water. The Ogallala can be up to 600 feet thick and is the major source of water in the county. The Niobrara River receives about 79 to 93 percent of its flow from groundwater baseflow (Newport and Krieger 1959). Wells in the Ogallala have average yields of 100 to 250 gpm and the transmissivity measured for the Ogallala in this area ranges from 940 to 4,000 feet squared per day. Groundwater quality is good, with TDS ranging from 100 to 250 mg/L (Newport and Krieger 1959).

The proposed route crosses land underlain by the Tertiary Brule aquifer from MP 595 to MP 597, and crosses the Keya Paha River and its alluvial aquifer at MP 598. From MP 599 to MP 612, the Project route crosses land underlain by the Ogallala aquifer. From MP 613 to MP 614, the Niobrara River and its alluvial aquifer and floodplain are crossed. The alluvial aquifer of the Niobrara is a major source of irrigation and municipal water supply.

Rock, Holt, Garfield, Wheeler, and Greely Counties

South of the Niobrara River, the proposed Project enters the Sand Hills area of north central Nebraska and continues through the area underlain by the Sand Hills and Ogallala aquifers throughout Rock, Holt, Garfield, and Greely Counties. The area of the Sand Hills has a shallow water table, often less than 30 feet bgs and the mean depth to water is approximately 20 feet (Stanton and Qi 2006). The soils are quite permeable, with an average soil permeability of 12.4 inches per hour, which is high for Nebraska. The water quality is good with a TDS below 500 mg/L, and often with a TDS below 250 mg/L. Because of the shallow groundwater table, groundwater seeps in depressions and hollows, often producing small ponds or lakes that become saline due to evaporation.

At approximately MP 625, the Project approaches the Elkhorn River and its tributaries. The route also passes within about 5 miles of Newport and Stuart. Both of these communities derive their water from the shallow groundwater along and near the Elkhorn River and its tributaries. Starting around MP 640, the proposed route enters an area of shallow lakes and flowing wells. From MP 640 to MP 660, the route passes within 5 miles of many small lakes and flowing wells. From MP 666 to MP 667, the route passes within 1 mile of Chain Lake.

Between MP 692 and MP 697, the proposed route passes within 2 miles downgradient of Ericson and crosses the Cedar River at MP 695. The water supply for Ericson comes from the alluvium of the Cedar River and from the Ogallala aquifer. Although Ericson is upgradient of the proposed crossing, there are potential water users downgradient within the alluvial aquifer of the Cedar River. Around MP 710, the route passes about 6 miles northeast of Greely.

Nance, Merrick, and Hamilton Counties

Nance, Merrick, and Hamilton Counties border the Platte River Valley and the Loup River Valley aquifers. This area is one of the most extensively irrigated areas in Nebraska, with 25 to as much as 75 percent of the land area under irrigation. The depth to water is 50 to 100 feet in the highland areas and less than 50 feet bgs in the lowland areas (Miller and Appel 1997). The Project route leaves the Sand Hills and enters the Ogallala aquifer to the Loup River. From the Loup River to the south bank of the Platte River into Hamilton County, the proposed Project route is within the Platte River Valley aquifer system.

At MP 726, the proposed route crosses the alluvial aquifer of the South Branch of Timber Creek. From MP 736 to MP 741, the route is in the floodplain and alluvial aquifer of the Loup River. This alluvial aquifer is used for irrigation and domestic water supply. From MP 744 to MP 757, the route is in the floodplain and alluvial aquifer of the Platte River Valley, where the depth to groundwater averages 5 feet (Stanton and Qi 2006), and the alluvial groundwater is used extensively for domestic, irrigation, and municipal water supply. The town of Central City is about 6 miles upstream from the crossing of the Platte River at MP 753 to MP 757.

Once the route crosses the floodplain of the Platte River, it enters the Eastern Nebraska glacial drift aquifer. Groundwater in this aquifer is used extensively for irrigation, domestic, and municipal water supply. Paleochannels cut into the bedrock beneath the glacial drift provide the best sources of water, especially for municipal water (Keech 1962). From MP 758 to MP 759, the route passes within 1 to 2 miles northeast of Hordville. Hordville’s public water supply comes from wells screened from 160 to 262 feet bgs in the glacial drift aquifer (Keech 1962). Groundwater flow near Hordville is generally to the east-northeast, away from Hordville. The water table elevation is around 1,670 feet amsl and the depth to water about 80 to 100 feet (Keech 1962).

York, Filmore, Saline, and Jefferson Counties

York, Filmore, Saline, and Jefferson Counties lie within the Quaternary glacial drift aquifer of eastern Nebraska (Stanton and Qi 2006). Groundwater has an average depth of about 79 feet and wells are often screened in either stream valley alluvium or paleochannels in the glacial outwash and drift.

At MP 775, the Project route passes 3 to 5 miles east of Bradshaw, and from MP 777 to MP 779 the route crosses the alluvial floodplain and aquifer of Beaver Creek. At MP 780, the proposed route crosses a mapped marsh south of Bear Creek and from MP 777 to MP 779 the line is about 5 to 7 miles west of the city of York. At MP 780, the Project crosses another marsh in the glacial drift and at MP 788 the proposed route crosses the floodplain and alluvial aquifer of the West Fork of the Big Blue River. Between MP 791 and MP 793, the pipeline crosses an area of marshes and passes less than 1 mile from the County Line Marsh. From MP 797 to MP 799, the route is approximately 2 to 3 miles west of Exeter. The proposed route crosses the alluvial floodplain of the South Fork of Turkey Creek between MP 806 and MP 807, and from MP 816 to MP 818, the pipeline is approximately 5 to 7 miles east of Tobias, Nebraska, in Saline County. The proposed Project route is 2 to 3 miles west of Western from MP 820 to 822, and approximately 1 to 3 miles east of some lakes formed along Cub Creek and its tributaries between MP 835 and 838. From MP 839 to MP 842, the route is 1 to 2 miles west of lakes along Big Indian Creek and about 10 to 12 miles northeast of Fairbury, Nebraska. The Project ROW joins the Keystone Pipeline Project ROW at approximately MP 844 in Jefferson County. The Steele City segment of the Project will connect to the Keystone Cushing Extension, at Steele City, 2.5 miles north of the Nebraska/Kansas state line.

3.5.3.5 Keystone Cushing Extension Pump Stations - Kansas

Construction associated with the Project will be limited to two new pump stations in two counties. New construction will occur in Clay and Butler Counties. No effects beyond those disclosed for the Project will be anticipated due to the addition of the Project pumping capacity.

3.5.3.6 Gulf Coast Segment - Oklahoma

Construction of the Gulf Coast Segment of the Project will begin in Payne County and extend south through a total of eight counties in eastern Oklahoma, transecting the eastern half of the state in an approximate north to south direction (Figure 3.5-45). Water for domestic, irrigation, and municipal use in Oklahoma comes mainly from the major rivers that cross the state from west to east. The proposed route will cross major rivers such as the North Canadian and Canadian Rivers, and the Red River when the route leaves Oklahoma and enters Texas. Each of these river crossings will entail crossing alluvial and terrace aquifers that have a high level of groundwater vulnerability (Oklahoma Water Resources Board 2008). The only major aquifer that will be crossed will be the Trinity (Antlers) aquifer in Atoka and Bryan Counties just north of the Red River, where the proposed route leaves the Central Lowlands physiographic province (Ryder 1996) and enters the Gulf Coast physiographic province. Along most of the proposed route across Oklahoma, the Project will be in areas where no principal aquifer has been mapped. These areas are underlain mainly by Permian clastic and evaporite sedimentary rocks. The route will pass just east of the Central Oklahoma aquifer, also known as the Garber-Wellington aquifer, and also will pass east of the Arbuckle-Simpson aquifer. The Project route will pass through the Ada-Vamoosa aquifer in Lincoln, Creek, Seminole, and Okfuskee Counties.

<u>Alluvial and Terrace Aquifers</u>

Alluvial and terrace aquifers are located with major rivers in Oklahoma. These aquifers provide the bulk of water supply in eastern Oklahoma (Ryder 1996) and have a shallow unconfined water table, making them vulnerable to contamination. These alluvial and terrace aquifers consist of Quaternary and late Tertiary deposits of sand and gravel interbedded with clays and silts. The alluvial aquifers are within the floodplain of the rivers. The terrace aquifers are in the terraces that border the alluvial floodplain and were once part of the floodplain of the ancestral river system. The alluvial deposits are often layered and can be up to 150 feet thick (Ryder 1996). The terrace deposits also are layered and can be up to about 100 feet thick. Depth to water is quite shallow in the alluvial aquifers, but can be in the range of 30 to 50 feet bgs in the terrace aquifers. The alluvial deposits can be 2 to 3 miles wide, while the alluvial plus the terrace deposits can be up to 15 miles wide at a river crossing.

The North Canadian River contains Pleistocene alluvial terraces along its north side. These high terraces range from 1 to 11 miles in width across the river and have an average thickness of about 70 feet (Ryder 1996). Lower terraces are found on both sides of the river and average about 50 feet in thickness and can be up to 2 miles in width. The Holocene alluvium of the floodplain averages about 30 feet in thickness. The depth to water ranges from 20 to 80 feet bgs and well yields range up to 1,000 gpm. The average measured hydraulic conductivity of the alluvial material is 59 feet per day. The groundwater in the alluvial and terrace aquifers is dominated by calcium bicarbonate and the TDS is low and generally below 500 mg/L (Ryder 1996). Modeling of groundwater flow in the alluvial and terrace aquifers near Oklahoma City found a hydraulic conductivity of 310 feet per day produced the best model results (Havens 1989). Recharge to the terraces ranges from 1.7 inches per year to 7.0 inches per year from west to east along the North Canadian River (Havens 1989). The measured specific conductance of groundwater in the alluvial aquifers (Havens 1989) ranges from 400 to 900 microsiemens/cm (TDS of 280 to 630 mg/L), while that of the river water ranges from 700 to 1,400 microsiemens/cm (TDS of 490 to 980 mg/L). The average transmissivity of the alluvial aquifer is around 6,900 feet squared per day. Measured water levels range from 1,130 feet amsl on the west near Midwest City to 880 feet amsl on the east near the Lincoln County line (Havens 1989).

The Canadian River flows from the Texas panhandle across Oklahoma. The alluvial and terrace aquifers are found in thick layers of sand that lie above the Permian bedrock and often below layers of silt and clay (Ryder

1996). Water quality is variable and often is influenced by upward flow from the Permian rocks below, resulting in salty water elevated in calcium sulfate. Water in the alluvial and terrace aquifers is usually better than stream water and locally usable for irrigation and domestic consumption. Well yields from the sand zone range up to 500 gpm. The alluvial aquifers can be 50 feet thick and the terrace aquifers around 80 feet thick. The measured hydraulic conductivity of the alluvial and terrace aquifer sands averages 134 feet/day (Ryder 1996).

The Red River separates Oklahoma and Texas. The alluvial and terrace aquifers are composed of sand, gravel, and clay up to 195 feet in thickness, but are typically around 70 feet thick (Ryder 1996). The saturated thickness is around 33 feet. The terrace aquifers supply municipal, domestic, and agricultural water to Texas and Oklahoma with about 75 percent of the water being used for agriculture and 17 percent for municipal water supply (Ryder 1996). Yields to wells range from 200 to 500 gpm and the TDS of the groundwater ranges from 1,000 to 2,000 mg/L.

<u>Bedrock Aquifers</u>

There are four main bedrock aquifers that the Project will either cross or approach. These are the Central Oklahoma or Garber-Wellington aquifer, the Arbuckle Simpson aquifer, the Ada-Vamoosa aquifer, and the Trinity or Antlers aquifer north of the Texas-Oklahoma state line.

The Central Oklahoma aquifer (Parkhurst et al. 1996; Carr and Marcher 1977) consists of Garber Sandstone and the underlying Wellington Formation. Groundwater in the Garber-Wellington aquifer is unconfined if the formations are exposed at the surface and confined if it underlies the Henessey Formation. The transmissivity of the Garber-Wellington aquifer ranges from 260 to 450 feet squared per day and the hydraulic conductivity averages around 4.5 feet per day. Water in the unconfined portions of the aquifer is less than 40 years old, based on tritium analyses (Parkhust et al. 1996), with a water quality dominated by calcium-magnesium bicarbonate. Water in the confined portions of the aquifer is dominated by sodium bicarbonate. Unconfined sections of the Garber-Wellington aquifer have local flow systems from recharge areas in the highlands to nearby rivers and creeks. Yields to wells range from 70 to 475 gpm (Carr and Marcher 1977) and the thickness of the unit ranges from 570 to 940 feet. Water levels in Logan County in the Garber-Wellington aquifer range from 1,050 to 1,100 feet amsl and well depths can be as shallow as 20 feet, but range up to 1,000 feet. The TDS in the upper 200 feet of the aquifer is generally below 500 mg/L, but underlying this fresh water is salty water with TDS values ranging up to 1,140 mg/L (Carr and Marcher 1977).

The Ada-Vamoosa aquifer outcrops in a narrow band in Creek, Lincoln, Okfuskee, Osage, Pawnee, Payne, Pontotoc, Pottawatomie, and Seminole Counties. The aquifer is composed of sandstone and interbedded shale of the Pennsylvanian Ada and Vamoosa groups. It dips to the west and has an average TDS less than 500 mg/L with the water quality dominated by sodium chloride and sulfate. Yields to wells range from 25 to 150 gpm, and the main use of the water is for domestic supply to small towns (Ryder 1996). The maximum thickness of the aquifer is around 900 feet. Withdrawals from the Ada-Vamoosa in 1985 are approximately 12 million gallons per day.

The Arbuckle-Simpson aquifer underlies the Arbuckle Mountains and Arbuckle Plains of south central Oklahoma (Ryder 1996). The aquifer covers parts of Carter, Coal, Johnston, Murray, and Pontotoc Counties. The aquifer consists of lower Paleozoic limestone, dolomite, and sandstone. The average transmissivity is approximately 15,000 feet squared per day due to fracturing. Fresh water can be found to depths of about 3,000 feet, and the estimated specific yield is around 20 percent (Ryder 1996). Yields to wells are generally in the range of 100 to 500 gpm, but can range up to 2,500 gpm. Springs are common in the Arbuckle Mountains and the water quality is dominated by calcium bicarbonate with an average TDS below 500 mg/L. The aquifer is largely undeveloped and produced about 5 million gallons per day in 1985 for public water supply (Ryder 1996).

The Trinity or Antlers aquifer is located along the Texas-Oklahoma state line both north and south of the Red River. The aquifer is in Cretaceous sandstones and unconfined in Atoka County, Oklahoma, but confined in

Bryan County, Oklahoma, and in Texas. The aquifer dips to the south toward the Gulf Coast. Water use in Oklahoma from this aquifer was about 1.4 billion gallons per year in 1985. The hydraulic conductivity ranges from 1 to 3.7 feet per day (Morton 1992) and the specific yield is 17 percent. The maximum saturated thickness is 2,000 feet. Water levels in the aquifer north of the Red River in Oklahoma range from 550 to 650 feet amsl in Atoka and Coal Counties (Morton 1992), with TDS from 300 to 1,200 mg/L (Ryder 1996). The water is used for public water supply, as well as for domestic irrigation and commercial water supply.

Lincoln, Creek, Okfuskee, and Seminole Counties

The Gulf Coast Segment begins at MP 0 in Payne County, and the route heads south to MP 1 in Lincoln County, Oklahoma. As the line enters Lincoln County, it passes a few miles east of the mapped extent of the Central Oklahoma, or Garber-Wellington, aquifer and is underlain by the Permian sediments and aquifer of the Garber Formation. From MP 9 through MP 11, the proposed route crosses drainages that supply water to Stroud Lake, which is approximately 3 miles downstream to the west of the Project. At MP 15, the proposed route passes approximately 1 mile east of Stroud, where the Project route enters the Ada-Vamoosa aquifer and remains in an area underlain by that aquifer as it passes through Creek, Okfuskeee and Seminole Counties. At MP 24, the Project crosses the floodplain and alluvial aquifer of the Deep Fork River in Creek County. The proposed route crosses the floodplain and alluvial aquifer of the North Canadian River in Seminole County at approximately MP 74 to MP 75.

Hughes, Coal, Atoka, and Bryan Counties

After entering Hughes County, the Project passes 1 mile west and upstream of a small lake in the Wewoka Creek drainage at 50. At MP 53, the proposed pipeline crosses George Creek 4 to 5 miles upstream of a lake formed by an impoundment, and crosses within 0.5 mile of another lake formed by impounding Jacobs Creek at MP 61. At MP 64, the Project is adjacent to a municipal airport and within 2 miles of Holdenville, Oklahoma. The Project crosses Bird Creek at approximately MP 61 and the Little River between MP 70 and MP 71. From MP 74 to MP 75, the proposed pipeline crosses the floodplain and alluvial aquifer of the Canadian River.

In Coal County, the Project will pass east of the mapped extent of the Arbuckle-Simpson aquifer, but within the actual eastern extent of that aquifer. At MP 98, the proposed route passes within 0.5 mile of Centrahoma. From MP 106 to MP 111, the route passes just east of Flagpole Mountain, which is part of the Arbuckle-Simpson aquifer.

Within Atoka County, the proposed route crosses the floodplain and alluvial aquifer of Clear Boggy Creek between approximately MP 125 and MP 127. As the route passes south of this creek and enters southern Atoka County and northern Bryan County, the route enters terrain underlain by the Trinity aquifer, also called the Antlers aquifer in Oklahoma. At approximately, MP 145, the Project passes 1 to 2 miles east of Bennington, Oklahoma. From MP 154 to MP 155, the route crosses the Red River and remains in the broad alluvial floodplain of the Red River as the proposed route enters Texas.

3.5.3.7 Gulf Coast Segment - Texas

The Gulf Coast segment of the Project crosses eastern Texas, starting at the Red River crossing in Fannin County and terminating at the oil refineries in Jefferson County on the Gulf Coast. The route will pass through 15 counties and cross terrain underlain by 3 principal aquifer systems: (1) the Trinity aquifer just south of the Red River; (2) the Texas Coastal Uplands aquifer system from southern Hopkins County to the Neches River in southern Angelina County; and (3) the Texas Coastal Lowlands aquifer system from Polk County to Jefferson County (Ryder 1996). The Texas Coastal Uplands aquifer system and the Texas Coastal Lowlands aquifer system are both composed of multiple aquifers that flow southeast toward the Gulf Coast. As the proposed pipeline route progresses south across southeast Texas, it will sequentially cross each one of the aquifers in these two aquifer systems. These aquifers are shown in Figure 3.5-4.

The Trinity aquifer consists of Cretaceous sandstone, siltstone, clay, conglomerate, shale, and some limestone. The aquifer is about 1,000 feet thick on average and has a transmissivity ranging from 150 to 2,400 feet squared per day and averaging about 840 feet squared per day. The hydraulic conductivity ranges from 0.7 to 9.0 feet per day and averages 4.0 feet per day (Ryder 1996). The salinity is generally less than 3,000 mg/L for wells 50 to 800 feet in depth. Well yields range from 50 to 500 gpm, and most wells used for domestic and agricultural water have a TDS less than 1,500 mg/L. Water levels in the aquifer range from 300 to 700 feet amsl. In Texas, the aquifer is confined, and the confining unit is the overlying impermeable unit referred to as the Midway Confining Unit. This unit forms the base of the Texas Coastal Uplands aquifer that overlies the Trinity aquifer in Texas. Where the proposed Project passes through Fannin, Lamar, Delta, and northern Hopkins Counties, it will be underlain by the Midway Confining Unit and thus will not encounter any aquifer units.

Starting in southern Hopkins County and continuing through southern Franklin, Wood, Smith, Cherokee, Rusk, Nacogodches, and Angelina Counties, the Project will be crossing the aquifers of the Texas Coastal Uplands aquifer system. The Texas Coastal Uplands aquifer system consists of two main aquifers; the Paleocene/Eocene Carrizo-Wilcox aquifer which is stratigraphically above the Midway Confining Unit, and the Eocene Claiborne aquifer which is above the Carrizo-Wilcox, and is separated from it by the lower Claiborne confining unit. The Claiborne aquifer is separated into the Sparta and the Queen City aquifers in other parts of Texas. Both aquifers dip to the southeast, toward the Gulf Coast, and consist of unconsolidated to partially consolidated sand, silt, gravel, and clay. The total thickness ranges up to 3,000 feet. The transmissivity of the Claiborne aquifer is around 4,600 to 6,000 feet squared per day; the transmissivity of the Carrizo-Wilcox aquifer is approximately 10,000 feet squared per day (Ryder and Ardis 2002). The average hydraulic conductivity of the Carrizo-Wilcox aquifer is approximately 10 feet per day. The Claiborne aquifer has an average thickness around 570 to 970 feet in the area traversed by the Project; the Carrizo-Wilcox aquifer averages 1,790 feet in thickness (Grubb 1997). The TDS of the groundwater in both aquifers ranges from 500 to 1,000 mg/L. Both aquifers are used extensively for agricultural irrigation water, domestic supply water, municipal water, and industrial supply water.

In Polk County, the Project crosses into terrain underlain by the Texas Coastal Lowlands aquifer system, which underlies the proposed route for the remainder of its transect through Polk, Liberty, Hardin, and Jefferson Counties, ending with the refineries near Beaumont. The Vicksburg-Jackson Confining Unit separates the Texas Coastal Uplands aquifer system from the overlying Texas Coastal Lowlands aquifer system. The USGS (Ryder 1996; Grubb 1997) has divided the aquifers of the Texas Coastal Lowlands system into 5 units labeled A through E. There are three main aquifers in this system. The lowermost aquifer stratigraphically is the Miocene Jasper aquifer. Above the Jasper are the late Tertiary Evangeline aquifer and the Quaternary Chicot aquifer. The latter two aquifers are used extensively for water supply in the Gulf Coast area from Houston to Galveston and Beaumont.

All three aquifers are composed of unconsolidated sand, silt, and clay, and flow southeast toward the Gulf Coast. The Jasper and Evangeline aquifers are 1,500 to 2,000 feet thick and the Chicot aquifer is 500 to 1,000 feet thick. The transmissivity of the Jasper aquifer is 7,000 to 10,000 feet squared per day, and the average hydraulic conductivity is around 15 to 16 feet per day (Ryder and Ardis 2002). The Evangeline aquifer generally has a transmissivity of 9,000 to 10,000 feet squared per day (with a range of 3,000 to 15,000 feet squared per day), and a average hydraulic conductivity between 15 and 23 feet per day (Kasmarek and Strom 2002). The Chicot aquifer has a transmissivity of approximately 6,900 feet squared per day (with a range of 3,000 to 50,000 feet squared per day) and an average hydraulic conductivity of 25 feet per day (Kasmarek and Strom 2002; Ryder and Ardis 2002). Fresh water use from the Chicot and Evangeline aquifers was around 1.1 billion gallons per day in 1985. Approximately 44 percent of this water was used for public water supply, and 41 percent was used for agricultural irrigation (Ryder 1996). Land surface subsidence in the Houston area from 1891 to 1995 was about 6 to 10 feet, and in the Galveston area subsidence was about 7 to 9 feet. From 1978 to 1995, land surface subsidence has been around 3.0 to 3.5 feet in the Houston area (Kasmarek and Strom 2002) due to groundwater withdrawal. Although water conservation measures have been implemented to reduce land surface subsidence in the Gulf Coast area, over the next 50 years, continued subsidence is possible and may affect the Project. Prolonged pumping of water from both the Chicot and Evangeline

aquifers in the Houston-Galveston area has lead to a depression in the water table in both areas, where the potentiometric surface is 100 to 300 feet below sea level. This resulted in a diversion of flow in both aquifers toward these two areas of intense groundwater pumpage (Kasmarek and Strom 2002).

Fannin, Lamar, Delta, and Northern Hopkins Counties

The Project route enters Texas in Fannin County as it crosses the Red River and remains within the alluvial floodplain aquifer of the Red River from MP 155 to MP 162. At MP 163 the route enters Lamar County and traverses the rolling uplands of southeast Texas. The route crosses the alluvial floodplain aquifer of North Sulfur Creek at MP 189, and from MP 199 to MP 201 the route crosses the alluvial floodplain aquifer of South Sulfur Creek. At MP 211, the route is within the alluvial floodplain aquifer of Oak Creek in northern Hopkins County. The route through these counties is underlain by the Midway Confining Unit, and thus there is no principal aquifer. Water for domestic and agricultural use comes mainly from streams and alluvial aquifers adjacent to streams.

Southern Hopkins, Franklin, Wood, Smith, Cherokee, Rusk, Nacogdoches, and Angelina Counties

From Oak Creek in northern Hopkins County through southern Hopkins and Angelina Counties, the Project terrain is underlain by the Texas Coastal Uplands aquifer. The Texas Coastal Uplands aquifer is used extensively for agricultural, domestic, and public water supply. At MP 226, the Project crosses Cypress Creek 1 to 2 miles upstream from Lake Franklin in Franklin County. From MP 230 to MP 232, the proposed route is about 2 miles east of Winnsboro, Texas. At MP 240, the pipeline crosses drainage approximately one-half mile upstream from Horseshoe Lake and crosses the floodplain of Big Sandy Creek along the Wood-Upshur county line from MP 254 to MP 255. The Project passes within 2 miles of Big Sandy and crosses the alluvial floodplain aquifer of the Sabine River between MP 259 and MP 261. From MP 262 to MP 290, the route passes through Smith County and rolling uplands dotted with small waterbodies, suggesting relatively saturated conditions in the underlying sandy aquifers. The route crosses the floodplain of Bowles Creek 2 to 3 miles upstream of Lake Striker between MP 297 and MP 299. Between MP 308 to MP 311, and again from MP 330 to MP 334, the Project crosses the broad alluvial floodplain aquifer of the Angelina River. The proposed route crosses the alluvial floodplain aquifer of the Neches River from MP 345 to MP 346 and MP 360 to MP 368. At the crossing of the Neches River, the route passes through terrain underlain by the Vicksburg-Jackson Confining Unit which separates the Texas Coastal Uplands aquifer system from the Texas Coastal Lowlands aquifer system.

Polk, Liberty, Hardin, and Jefferson Counties

The terrain underlying Polk, Liberty, Hardin, and Jefferson Counties consists of the Texas Coastal Lowlands aquifer system. The aquifers in this system are saturated or nearly saturated most of the year due to the heavy rains common in this part of southeast Texas, and due to the sandy nature of these unconsolidated sediments. The Project route will encounter wet to saturated sandy soils as it traverses these counties. From MP 374 to MP 376, the route passes about 2 miles west of Corrigan and very near the community of Pleasant Hill. From MP 398 to MP 406, the route crosses the broad floodplain alluvial aquifer of Menard Creek. The route is within 1 mile of Big Thicket between MP 410 and MP 415. From MP 415 to the end of the line, the Project is in the heavily populated coastal lowland area containing both Beaumont and Baytown. This area contains the Chicot aquifer where the overlying soils are saturated and often flooded during heavy rains. This area may present problems for trench construction, depending on the season and amount of rainfall.

3.5.3.8 Texas – Houston Lateral

Liberty, Chamber, Harris Counties

The Houston Lateral connects to the Gulf Coast Segment at MP 431 in Liberty County and runs south-southeast to Houston (Figure 3.5-4). At MP 7 and MP 10, west of Daisetta, Texas, the Lateral is adjacent to surface water storage reservoirs. At MP 11, the Lateral is located just west of the Liberty Municipal Airport.

The lateral crosses the Trinity River between MP 21 and MP 23 and crosses the Old River between MP 27 and MP 28. From MP 34 to MP 35 in Chambers County, the proposed route runs south of storage reservoirs. In Harris County, from MP 41 to MP 44, the Project runs through swampy, marshy land in the floodplain of the San Jacinto River that connects Lake Houston and the Galveston Bay area around Baytown. The Houston Lateral terminates at MP 47 where it passes through land underlain by the Chicot aquifer and soils that are frequently saturated from heavy rains.

3.5.4 Water Supplies and Wells

The Project would pass through six states and cross rivers where the surface and groundwater are often used for public water supply, domestic water supply, and irrigation water supply. Some segments of the proposed route would pass close to existing municipalities or the sources of water for those communities. Table 3.5.4-1 summarizes the segments along the Project that would pass within 1 mile of potential sources of public water supply. This section discusses segments of the proposed route that may be within a few miles of a source water protection area (SWPA), or within 5 miles of municipalities that may have PWS wellfields, but where no SWPA is currently designated.

<u>Montana</u>

In Montana, the Project would not be within 1 mile or less of any known SWPA. The segment of the route near Nashua, Montana (MP 83-85), would pass within about 1.5 to 2.0 miles of the PWS for the town of Nashua (SWPA MT0000297). The source of water for Nashua consists of 3 wells screened in the alluvial aquifer of the Milk River at depths from 44 to 57 feet bgs. The proposed route would pass southwest and upgradient of the wells, but would not be within the calculated and mapped capture zone of the municipal wells (MTRWA 2005). Thus, it is not likely that the Project would affect these wells. For the town of Glasgow, Montana (MP SC 70), the proposed route would pass about 4 to 5 miles northeast of the town and be at least 3 miles from any of the 9 designated SWPA's in and around the town of Glasgow. From MP 66 to MP 69, the pipeline would cross Cherry Creek upgradient of Glasgow. Cherry Creek feeds into Glasgow near the location of the PWS wells along the Milk River. In McCone County, the proposed route passes within 1.5 to 2.0 miles of the Circle SWPA (MT00003314) at MP 145 to MP 147. The PWS wells for Circle are south of town along the Redwater River. The Project would pass northeast of town and downgradient from the wells. At MP 163, in Dawson County, the proposed route would pass within 1 mile of two mapped wells near Rimroad, Montana. There is no designated SWPA for Rimroad. In Fallon County, the Project would pass within 1.5 to 2.0 miles of the SWPA for Baker, Montana (MT0000021). The pipeline would cross Sandstone Creek west and upgradient from the PWS wells. The pipeline would pass within 1 mile of the Cornwell Reservoir at MP 59 and within 1 mile of the Haynie Reservoir at MP 134. These are mapped reservoirs used for irrigation and stock watering.

<u>South Dakota</u>

In South Dakota, the Project would pass within 2.0 miles of the town of Buffalo, but about .3 miles east of the 1.0 mile radius SWPA protective zone from MP 316 to MP 318. At Winner, in Tripp County, the centerline would pass within 2.0 miles of the PWS for Winner, but would be northeast of the maximum extent of the 1.0 mile radius protective zone for the Winner SWPA from MP 570 to MP 572. At MP 564, the pipeline would be 1.8 miles southwest of the town of Winner. The proposed centerline would pass through the center of the Colome SWPA in Tripp County from MP 573 to MP 574 and be within approximately 0.25 miles of the PWS wells. Groundwater in the Colome SWPA (EPAID No. 0094; SDDENR 2003) comes from two wells screened at shallow depths less than 54 feet bgs in the Tertiary Ogallala aquifer (Schulz 1994). The formation used for public water supply is the Valentine Formation and the two PWS wells have screen lengths of 28 feet in a sand-rich aquifer with a saturated thickness ranging from 30 to 60 feet (Barari 1969). The wells have a maximum pumping capacity of about 50 gpm (Barari 1969). At MP SC 415, the Project would pass within 1.0 miles of the Wilson Lake Reservoir, and at MP 457 the centerline would be within 1.0 miles of the small town of Lucerne. At MP 450, the pipeline would be 1.5 miles northeast of the town of Midland along the Bad River. From MP 504 to MP 506, the route would be 2.5 miles northeast of the SWPA for Murdo and 5.0 miles from the town of Murdo. At MP 511, the Project would be 2.0 miles southwest of Draper.

Nebraska

In Nebraska, the Project would not pass through any mapped PWS wellhead protection areas, but the proposed route would pass near 18 SWPA's as it traverses the state. For the towns of Erickson, Hordville, McCool Junction, Exeter, Jansen, Steele City, and the Rock Creek State Park, the proposed route would be within 1 mile or less of the maximum mapped extent of the SWPA. For the towns of Exeter, Western, Jansen, Steele City, and Hordville, the pipeline would be within 1 mile of the approximate center of the mapped SWPA. This would also apply to an SWPA mapped in T11N, R4W, sections 10, 11, 14, 14 near MP 772 in Hamilton County and the SWPA mapped in T10N, R3W, sections 25, 26, and 36 in York County near MP 782-784. In the vicinity of Western, Nebraska, the proposed route from MP 822 to MP 823 would pass through the northeastern part of section 29, T5N, R2E, and come close to the southwest corner of section 28. The community of Western is planning a new PWS well that is expected to have a wellhead protection zone that would encompass all of section 28. The water table in section 28 is approximately 54 feet bgs and the well screen would be located in the sand and gravel zone about 60 feet below the water table (Hanson 2008). A clay zone ranging from 30 to 100 feet in thickness separates the surface from the confined aquifer in the sand and gravel zone. The new well would be grouted to the top of the well screen. The thick clay zone and the depth of the well screen in the proposed new well should prevent surface contamination from entering the well. The Project would also pass about 2.5 miles southwest of Stuart at MP 628 and within 3.0 to 4.0 miles of both the Clarks and Central City SWPA's at MP 752. At MP 762, the centerline would be about 2.5 miles southwest of the Polk SWPA and at MP 778, the Project would be 3.0 miles southwest of York. The Milligan SWPA would be 1.5 miles southwest of the centerline at MP 809.

Kansas

In Kansas, wellhead protection areas and SWPA's have three zones of protection defined (KDHE 2008). For groundwater wells, Zone A is a protection zone with a radius of 100 feet. Zone B is a protection zone with a radius of 2,000 feet. Zone C is the most extensive zone and consists of a 2-mile radius buffer around the public water supply wells. Throughout Kansas, Zone C buffers commonly contain potential sources of groundwater contamination such as gasoline stations, feedlots, agricultural storage areas, manufacturing plants, and truck repair shops. Zone A is usually owned by the municipality and thus activity within that zone is restricted. Zone B is considered a sensitive protection zone and industrial activities in that zone are closely monitored. Zone C has monitoring only for industrial and domestic or agricultural activities that may pose a threat to groundwater. Most industrial activities are examined by state inspectors and have protection plans in place to protect groundwater, and thus are not monitored. SWPA reports are available online at http://www.kdhe.state.ks.us/nps/swap for most municipalities.

The Cushing Extension in Kansas will pass through or very close to the Zone C protection areas for 8 municipalities. However, no new pump stations would be constructed within any Zone C buffer areas. For all of these areas that have available SWPA assessment reports, all wells are greater than 30 feet bgs. For Hollenberg, the pipeline directly downstream of pump station 26, would be within the Zone C protection zone from MP 2 to MP 5 and come within about 0.35 miles of the SWPA in the town of Hollenberg (Table 3.5-4).

Near Chapman, between pump stations 27 and 28, the Cushing Extension passes through the western part of Zone C from MP 72 to MP 76 and is within 0.35 miles of one SWPA and within 1.5 miles of the other 4 SWPA's in this Zone C buffer. The Chapmpan SWA area within 1 mile of the Cushing Extension is SWA area 68 and contains a variety of potential sources of contamination ranging from oil company storage tanks to septic systems, gas stations, and feed lots. At Augusta, downstream of pump station 29, MP 163 to MP 165 of the Cushing Extension is within the Zone C buffer for both Augusta and the Santa Fe Lake Park that lies west of Augusta. For small towns, pump station 27 would be closest to Wakefield at MP 58 of the Cushing Extension. Pump station 29 would be slightly upstream of Peabody at MP 131 of the Cushing Extension and downstream of Towanda at MP 156.

Kansas also has designated water resource protection areas (WRAPS) that contain both surface water and groundwater diversion zones (Brown 2008). In Washington County, the Cushing Extension would pass

through the Lower Little Blue WRAPS and pass within 1 mile of four plotted wells. In Clay County, the Cushing Extension would pass through the Lower Republican WRAPS and pass within 1 mile of eight plotted wells. For Marion County, the Cushing Extension would pass through the Upper Cottonwood WRAPS and pass within 1.0 miles of one plotted well. The location of the groundwater wells in the WRAPS is approximate (Brown 2008) and the use of the wells as well as their status is not designated.

Oklahoma

The Project would pass near 11 cities or towns in Oklahoma (Table 3.5-4). At Cushing, just upstream of the start of the pump station at the northernmost end of the Gulf Coast segment (MP 294 to MP 296 of the Cushing Extension), the route is about 1.0 miles southwest of town. For towns like Stroud, Holdenville, Cromwell, and Allen, the route lies within about 1.0 miles or less of the town. Starting with Colgate, the Project is within 1.0 miles or less of 6 PWS wells. At Lehigh, the route comes within 1.0 mile or less of 7 PWS wells. For Bennington, the route is within a mile or less of 3 PWS wells. For all the towns listed on Table 3.5-4, the proposed route is within the SWPA of the municipal water supply wells. The Project passes within 3 miles or less of four other towns in Oklahoma. At MP 221, the centerline is within 2.5 miles of Newkirk in Kay County. At MP 34, the Project is within 2.0 miles of Paden to the northwest and Boley to the southeast. At MP 59, the route is within 2.0 miles of Wenoka.

Texas

The Project would pass within 1.0 miles of 34 cities or towns in Texas (Table 3.5-4). Near Big Sandy, from MP 249 to MP 261, the proposed route would pass near 15 SWPA's. At Starrville, MP 268, the route would pass near 5 SWPA's. There are 6 mapped SWPA's near the proposed route at MP 277 near Douglas. The towns of Arp (MP 288) and Wells (MP 325) are along the proposed route and each has two mapped SWPA's. Clarks Ferry (MP 365) has 8 mapped SWPA's and the town of Soda (MP 396) has 2 mapped SWPA's. Around MP 412, the proposed route would pass near 6 mapped SWPA's. Near the end of the main line, the route would pass near Central Gardens, Nederland, and Port Neches, Texas. Along the Houston Lateral, the route would pass near Barrett, Highlands, and Cloverleaf, Texas.

The Project passes within 3.0 miles of 11 other towns in Texas. At MP 214, the centerline is within 2.0 miles of Saltillo, and at MP 231 the route is within 2.0 miles of Winnsboro. Perryville is within 2.5 miles of the centerline at MP 238, Shady Grove is 1.8 miles southeast of the centerline at MP 251, and Big Sandy is 2.0 miles southeast of the route at MP 258. At MP 375, the centerline is 2.0 miles from Snow Hill to the southwest and Corrigan to the west. Rye is 2.0 miles from the route at MP 415, and Clarks is 2.0 miles from the proposed route at MP 419. Along the Houston Lateral, Daisetta is 2.0 miles from the line at MP 8. Along the Gulf Coast segment, Sour Lake is about 3.0 miles from the centerline at MP 446.

Table 3.5-4 Public Water Supplies (PWS) within 1 mile of the Project Centerline

County	Approximate Mile Post Marker	Distance From CL (feet)	Cardinal Direction from CL
Steele City Segment			
Montana			
None			
South Dakota			
Tripp	573-574	<0.3	NE
Nebraska			
Hamilton	772	1	W
York	782-784	1	NE
Filmore	798	1	NE
Hamilton	759	1	W

Table 3.5-4 Public Water Supplies (PWS) within 1 mile of the Project Centerline

County	Approximate Mile Post Marker	Distance From CL (feet)	Cardinal Direction from CL
Saline	822	1	NE
Jefferson	837	1	SW
Jefferson	850	1	W
Gulf Coast Segment			
Oklahoma			
Hughes	80	3320.9	NW
Hughes	80	3276.4	NW
Hughes	80	2699.9	NW
Hughes	80	3034.6	NW
Coal	98	3249.2	NE
Coal	104	1788.4	SW
Coal	105	4961.2	SW
Coal	106	1830.7	NE
Coal	107	2405.4	NE
Coal	107	1905.3	NE
Coal	108	3425.2	NE
Coal	108	4211.5	NE
Coal	108	3755.7	NE
Coal	108	3178.0	NE
Coal	110	2846.5	NE
Coal	110	3023.4	NE
Coal	110	2497.8	NE
Coal	110	2157.7	NE
Coal	110	2360.5	NE
Coal	110	2530.3	NE
Coal	111	2251.6	NE
Bryan	143	2495.9	SW
Bryan	143	2495.1	SW
Bryan	144	4427.0	SW
Texas			
Lamar	165	5093.7	SW
Lamar	167	3636.2	SW
Lamar	171	3094.6	SW
Lamar	171	2875.1	SW
Lamar	171	1854.7	SW
Lamar	178	4557.3	NE
Lamar	179	3670.7	SW
Delta	191	777.0	NE
Delta	192	2987.7	SW
Hopkins	222	4086.6	SW
Hopkins	222	4611.2	SW

Table 3.5-4 Public Water Supplies (PWS) within 1 mile of the Project Centerline

County	Approximate Mile Post Marker	Distance From CL (feet)	Cardinal Direction from CL
Franklin	222	2418.1	NE
Franklin	222	2742.0	NE
Franklin	225	1129.1	NE
Franklin	225	1129.1	NE
Franklin	225	1129.1	NE
Franklin	225	1129.1	NE
Franklin	225	1129.1	NE
Franklin	225	1129.1	NE
Franklin	225	4166.4	NE
Franklin	228	4168.6	SW
Franklin	228	4168.6	SW
Franklin	228	4168.6	SW
Franklin	228	4168.6	SW
Franklin	228	4168.6	SW
Franklin	228	4168.6	SW
Franklin	229	5195.6	SW
Franklin	229	3866.3	SW
Franklin	229	5022.3	SW
Franklin	229	1032.3	SW
Franklin	231	4987.5	NE
Franklin	231	4987.5	NE
Wood	233	2427.2	SW
Wood	233	2793.9	NE
Wood	233	3087.6	NE
Wood	234	1575.1	NE
Wood	234	2835.4	SW
Wood	236	1015.2	SW
Wood	236	1352.4	NE
Wood	237	3560.8	SW
Wood	237	773.9	NE
Wood	237	524.9	NE
Wood	237	591.3	SW
Wood	239	1185.8	SW
Wood	240	4867.5	NE
Wood	241	726.5	NE
Wood	242	1052.3	SW
Wood	242	1293.5	SW
Wood	242	50.0	SW
Wood	243	5182.7	SW
Wood	243	2905.5	NE
Wood	244	4496.1	SW

Table 3.5-4 Public Water Supplies (PWS) within 1 mile of the Project Centerline

County	Approximate Mile Post Marker	Distance From CL (feet)	Cardinal Direction from CL
Wood	244	2983.0	SW
Wood	245	2880.8	NE
Wood	245	3827.2	NE
Wood	246	3326.6	NE
Wood	246	2734.6	NE
Wood	246	3446.2	NE
Wood	246	1.5	SW
Wood	248	3462.7	SW
Wood	249	2907.8	SW
Wood	249	1340.8	NE
Wood	250	5095.7	SW
Wood	251	4963.3	SW
Upshur	252	4457.1	SE
Upshur	252	4440.1	SE
Upshur	252	3930.0	NE
Upshur	252	3930.0	NE
Wood	258	4766.2	SW
Smith	260	2629.6	SW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW

Table 3.5-4 Public Water Supplies (PWS) within 1 mile of the Project Centerline

County	Approximate Mile Post Marker	Distance From CL (feet)	Cardinal Direction from CL
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Upshur	261	1693.0	NW
Smith	263	3244.7	NW
Smith	263	1287.1	NW
Smith	264	2695.4	NW
Smith	265	1956.4	SW
Smith	268	270.8	SW
Smith	268	422.5	SW
Smith	269	3492.8	SW
Smith	269	3578.7	SW
Smith	270	685.0	NE
Smith	271	2986.7	NE
Smith	272	3994.2	SW
Smith	272	1258.9	SW
Smith	272	2582.1	SW
Smith	272	1622.5	SW
Smith	272	2813.2	NE
Smith	272	3062.6	NE
Smith	273	4191.0	SW
Smith	273	1256.3	SE
Smith	274	1016.6	SW

Table 3.5-4 Public Water Supplies (PWS) within 1 mile of the Project Centerline

County	Approximate Mile Post Marker	Distance From CL (feet)	Cardinal Direction from CL
Smith	275	378.3	SW
Smith	275	4702.6	NE
Smith	277	1084.3	NE
Smith	278	2357.3	SW
Smith	280	2577.8	SW
Smith	280	4884.5	SW
Smith	280	4884.5	SW
Smith	280	2357.2	NE
Smith	280	2268.1	NE
Smith	281	1070.3	NE
Smith	281	1262.2	NE
Smith	282	1930.7	NE
Smith	283	3699.2	SW
Smith	284	548.2	NE
Smith	285	3746.8	SW
Smith	285	3801.5	SW
Smith	285	3809.0	SW
Smith	285	4362.2	SW
Smith	285	4216.3	SW
Smith	285	4224.5	SW
Smith	285	3054.2	SE
Smith	285	1222.0	NE
Smith	285	1232.8	NE
Smith	286	4524.9	SW
Smith	286	474.4	SW
Smith	287	4279.2	SW
Smith	287	2759.2	NW
Smith	287	163.0	SW
Smith	288	5166.6	SW
Smith	288	473.3	NE
Smith	288	1671.9	NE
Smith	289	3526.6	SW
Cherokee	293	3770.4	SW
Cherokee	293	394.8	SW
Cherokee	294	2358.9	SW
Cherokee	294	3935.4	NE
Cherokee	294	5158.3	NE
Cherokee	295	591.4	SW
Cherokee	295	3714.8	SW
Cherokee	296	1012.9	SW
Cherokee	297	244.4	NE

Table 3.5-4 Public Water Supplies (PWS) within 1 mile of the Project Centerline

County	Approximate Mile Post Marker	Distance From CL (feet)	Cardinal Direction from CL
Cherokee	298	1394.5	SW
Cherokee	298	1017.4	NE
Rusk	300	618.8	NE
Rusk	300	2568.6	NE
Rusk	300	2568.6	NE
Rusk	300	2568.6	NE
Rusk	300	2568.6	NE
Rusk	300	2110.8	NE
Rusk	302	3699.6	SW
Rusk	302	2445.4	SW
Rusk	302	1304.9	SW
Rusk	303	3989.7	SW
Rusk	306	1375.4	SW
Rusk	306	276.7	SW
Rusk	306	746.4	SW
Rusk	306	753.5	SW
Rusk	308	1657.1	NE
Rusk	310	3547.1	SW
Rusk	311	3115.9	NE
Rusk	312	2557.7	SW
Nacogdoches	314	3529.0	SW
Nacogdoches	314	3372.5	SW
Nacogdoches	314	4130.7	SW
Nacogdoches	314	4130.7	SW
Nacogdoches	314	4219.3	SW
Nacogdoches	314	4138.1	SW
Nacogdoches	315	3992.2	NE
Nacogdoches	315	2977.4	SW
Nacogdoches	315	4066.0	SW
Nacogdoches	317	3568.8	NE
Nacogdoches	317	2335.3	NE
Nacogdoches	318	5124.7	NE
Nacogdoches	320	712.1	NE
Nacogdoches	320	723.0	NE
Nacogdoches	320	736.0	NE
Nacogdoches	321	2866.9	NW
Nacogdoches	321	1400.2	SW
Nacogdoches	321	1314.6	SW
Nacogdoches	322	2158.4	NE
Nacogdoches	322	2464.5	SW
Nacogdoches	324	1713.4	SW

Table 3.5-4 Public Water Supplies (PWS) within 1 mile of the Project Centerline

County	Approximate Mile Post Marker	Distance From CL (feet)	Cardinal Direction from CL
Nacogdoches	324	409.9	SW
Nacogdoches	325	3709.3	SE
Nacogdoches	326	3986.6	SE
Nacogdoches	326	2372.7	SE
Nacogdoches	326	1882.6	NW
Nacogdoches	326	265.2	NW
Nacogdoches	326	2156.2	NW
Nacogdoches	326	2116.9	NW
Nacogdoches	326	1922.0	NW
Nacogdoches	326	3307.4	NW
Nacogdoches	326	1691.0	NW
Nacogdoches	326	1691.0	NW
Nacogdoches	326	1628.6	NW
Nacogdoches	326	1568.7	NW
Nacogdoches	326	1761.3	NW
Nacogdoches	326	1761.3	NW
Nacogdoches	327	1553.9	NW
Nacogdoches	328	2144.0	NW
Nacogdoches	329	2986.6	NW
Nacogdoches	330	644.6	SE
Nacogdoches	332	4774.0	SE
Cherokee	333	2761.2	NW
Cherokee	336	1250.7	NW
Cherokee	337	4742.4	NE
Angelina	340	4237.2	SE
Angelina	340	1558.9	NE
Angelina	340	3292.6	SE
Angelina	341	2443.2	SE
Angelina	342	3396.3	NW
Angelina	342	2620.6	SE
Angelina	348	3496.7	NE
Angelina	350	2581.1	NE
Angelina	350	2797.0	NE
Angelina	354	3963.1	NE
Angelina	354	3649.0	NE
Angelina	354	3663.2	NE
Angelina	360	3591.3	NE
Polk	366	3331.3	SW
Polk	369	3396.8	SE
Polk	369	5042.4	SE
Polk	369	5129.0	SE

Table 3.5-4 Public Water Supplies (PWS) within 1 mile of the Project Centerline

County	Approximate Mile Post Marker	Distance From CL (feet)	Cardinal Direction from CL
Polk	369	5215.7	SE
Polk	369	2949.6	SW
Polk	370	5.4	SW
Polk	370	3103.1	NE
Polk	370	3445.1	NE
Polk	370	3445.1	NE
Polk	370	3357.1	NE
Polk	372	1472.3	NE
Polk	372	1472.3	NE
Polk	372	1320.4	SE
Polk	372	1577.5	SE
Polk	373	1062.4	NW
Polk	373	356.4	SW
Polk	374	4121.3	NW
Polk	375	627.0	SW
Polk	375	3576.0	NW
Polk	375	3066.1	NW
Polk	375	1096.9	SW
Polk	377	2927.9	SE
Polk	377	2927.9	SE
Polk	379	1662.1	NE
Polk	379	3817.3	SE
Polk	380	5104.6	SE
Polk	389	4224.8	NE
Polk	390	2228.0	NW
Polk	396	2227.8	NW
Polk	396	2317.6	NW
Polk	396	4725.6	SW
Polk	396	4725.6	SW
Polk	396	4833.0	SW
Polk	396	4745.9	SW
Polk	396	2216.0	NE
Polk	396	2214.1	SE
Polk	396	4753.5	NW
Polk	396	4231.2	NW
Polk	396	3795.8	NW
Polk	396	2419.9	NW
Polk	396	2174.5	NW
Polk	396	1849.9	SE
Polk	397	4913.4	NW
Polk	397	3291.1	SE

Table 3.5-4 Public Water Supplies (PWS) within 1 mile of the Project Centerline

County	Approximate Mile Post Marker	Distance From CL (feet)	Cardinal Direction from CL
Polk	397	1012.1	SE
Polk	397	1012.1	SE
Polk	397	3274.0	SE
Polk	400	2106.9	SE
Polk	401	3874.6	NW
Polk	403	3399.4	NW
Polk	403	4215.4	SE
Polk	404	5010.0	NW
Polk	404	2848.6	NW
Polk	404	3031.7	NW
Polk	404	4450.9	NW
Polk	404	5092.8	NW
Polk	405	4149.9	NW
Polk	407	2440.6	SW
Polk	407	4655.8	SW
Polk	407	4655.8	SW
Polk	407	3712.9	SW
Polk	407	3322.0	SW
Polk	407	2415.9	SW
Polk	409	4552.0	SW
Polk	409	2477.0	SW
Polk	409	2475.1	SW
Polk	409	5058.7	SW
Polk	410	3248.3	NE
Polk	410	547.2	SW
Polk	411	3690.6	SW
Polk	411	3327.3	NE
Polk	411	5157.3	NE
Polk	411	215.5	SW
Liberty	412	973.2	NE
Liberty	412	91.8	SW
Liberty	412	513.7	NE
Liberty	412	3010.7	NE
Liberty	412	2812.8	NE
Liberty	412	414.4	NE
Liberty	412	2584.3	NE
Polk	412	1656.8	NE
Polk	412	1671.9	NE
Polk	412	1693.5	NE
Liberty	413	1336.7	NE
Liberty	413	1541.6	NE

Table 3.5-4 Public Water Supplies (PWS) within 1 mile of the Project Centerline

County	Approximate Mile Post Marker	Distance From CL (feet)	Cardinal Direction from CL
Liberty	414	4985.4	SW
Liberty	414	3892.8	SW
Liberty	414	3772.4	SW
Liberty	414	4418.0	SW
Liberty	414	3261.6	SW
Liberty	414	2755.7	SW
Liberty	414	2568.7	NE
Liberty	414	4153.1	NE
Liberty	414	4164.6	NE
Liberty	415	4838.0	SW
Liberty	415	2809.4	SW
Liberty	415	2546.1	SW
Liberty	419	3421.4	SW
Liberty	422	3776.1	SW
Liberty	423	4123.9	SW
Liberty	423	3956.4	SW
Liberty	423	3872.5	SW
Liberty	427	2849.5	SW
Liberty	428	4770.9	SW
Liberty	428	4459.5	SW
Liberty	435	2659.2	SW
Liberty	435	4030.6	SW
Hardin	438	2593.8	NE
Hardin	439	3565.9	NE
Hardin	440	714.8	NE
Hardin	445	2491.9	SW
Hardin	446	2129.6	NE
Jefferson	450	5172.3	SW
Hardin	450	3810.2	NE
Hardin	450	4296.5	NE
Hardin	450	4369.3	NE
Jefferson	451	680.2	NE
Jefferson	455	2223.3	SE
Jefferson	455	136.7	SE
Jefferson	455	1863.3	NW
Jefferson	456	4656.6	SW
Jefferson	456	1185.5	NE
Jefferson	457	3362.3	SW
Jefferson	457	149.5	NE
Jefferson	457	747.9	NW
Jefferson	457	990.2	NE

Table 3.5-4 Public Water Supplies (PWS) within 1 mile of the Project Centerline

County	Approximate Mile Post Marker	Distance From CL (feet)	Cardinal Direction from CL
Jefferson	458	4375.8	SW
Jefferson	458	3622.9	SW
Jefferson	458	2694.7	NE
Jefferson	460	386.6	SW
Jefferson	460	2931.8	NE
Jefferson	461	2879.7	SW
Jefferson	461	3558.9	SW
Jefferson	461	2395.8	SW
Jefferson	461	3048.7	NE
Jefferson	461	3986.2	NE
Jefferson	461	1481.8	NE
Jefferson	462	5099.6	NE
Jefferson	464	2330.7	SW
Jefferson	464	2197.2	SW
Jefferson	464	2832.9	SW
Jefferson	464	3005.6	NE
Jefferson	464	4712.9	NE
Jefferson	465	39.5	NE
Jefferson	465	39.5	NE
Jefferson	467	1103.1	NE
Jefferson	467	3454.3	NE
Jefferson	468	3104.3	NE
Jefferson	468	4606.1	NE
Jefferson	472	2215.2	NE
Jefferson	472	2215.2	NE
Jefferson	473	4413.1	SE
Jefferson	476	3914.2	SE
Jefferson	476	3661.4	SE
Jefferson	476	2876.7	SW
Jefferson	476	1630.0	NW
Jefferson	476	1711.3	NE
Jefferson	476	5006.6	NE
Jefferson	477	4132.8	SW
Jefferson	477	3979.5	SW
Jefferson	477	572.7	SE
Jefferson	477	1327.2	NW
Jefferson	477	491.5	NW
Jefferson	477	2447.2	NW
Jefferson	477	4933.6	NW
Jefferson	478	687.0	SE
Jefferson	478	687.0	SE

Table 3.5-4 Public Water Supplies (PWS) within 1 mile of the Project Centerline

County	Approximate Mile Post Marker	Distance From CL (feet)	Cardinal Direction from CL
Jefferson	478	687.0	SE
Jefferson	478	687.0	SE
Jefferson	478	687.0	SE
Jefferson	478	4790.0	SE
Jefferson	478	4790.0	SE
Jefferson	478	4790.0	SE
Jefferson	478	4790.0	SE
Jefferson	478	4790.0	SE
Jefferson	478	4790.0	SE
Jefferson	478	4790.0	SE
Jefferson	478	4790.0	SE
Jefferson	478	346.2	NE
Jefferson	478	4484.6	NE
Jefferson	478	4932.9	NE
Jefferson	478	966.4	NE
Jefferson	478	4098.8	NE
Jefferson	478	2511.8	NE
Houston Lateral			
Texas			
Liberty	1.8	4499.3	SE
Liberty	11.4	2641.4	SE
Liberty	17.6	826.8	SE
Liberty	18.4	720.5	SE
Liberty	21.8	417.4	SE
Liberty	21.8	419.0	SE
Liberty	21.8	312.7	SE
Liberty	21.8	317.5	SE
Liberty	21.8	317.3	SE
Liberty	21.8	317.3	SE
Liberty	21.8	317.3	SE
Liberty	21.8	317.3	SE
Liberty	21.8	317.3	SE
Liberty	21.8	316.0	SE
Liberty	21.8	316.0	SE
Liberty	21.8	316.0	SE
Liberty	21.8	316.0	SE
Liberty	21.8	316.0	SE
Liberty	21.8	316.0	SE
Liberty	21.8	316.0	SE
Liberty	21.8	3853.8	SE
Liberty	21.9	951.0	NW

Table 3.5-4 Public Water Supplies (PWS) within 1 mile of the Project Centerline

County	Approximate Mile Post Marker	Distance From CL (feet)	Cardinal Direction from CL
Liberty	25.1	1841.0	SE
Liberty	25.5	4356.9	NW
Harris	34.2	4826.4	SE
Harris	36.1	1867.7	SE
Harris	36.3	4236.1	SE
Harris	36.4	2907.5	SE
Harris	36.7	3758.6	SW
Harris	36.7	2840.7	SE
Harris	36.8	41.5	NW
Harris	36.8	2155.8	SE
Harris	37.2	1064.3	NW
Harris	37.2	1580.9	NW
Harris	37.4	1633.6	NW
Harris	37.6	1633.6	NW
Harris	37.7	1633.6	NW
Harris	37.9	1633.6	NW
Harris	38.6	1633.6	NW
Harris	38.6	1915.7	NW
Harris	40.2	1909.8	NW
Harris	40.4	2003.7	NW
Harris	40.4	2003.7	NW
Harris	40.7	1869.4	NW
Harris	40.7	1869.4	NW
Harris	42.5	2703.7	NW
Harris	43.1	2800.6	NW
Harris	43.1	2785.8	NW
Harris	43.2	2785.8	NW
Harris	43.2	2785.8	NW
Harris	43.8	3867.2	SE
Harris	44.2	3111.4	NW
Harris	44.4	3796.8	SE
Harris	44.4	3002.4	NW
Harris	44.4	3212.2	NW
Harris	44.6	3103.5	NW
Harris	44.6	3311.8	NW
Harris	44.6	3414.7	NW
Harris	44.6	3412.9	NW
Harris	44.6	3411.0	NW
Harris	45.1	3411.0	NW
Harris	45.1	3409.2	NW
Harris	45.2	3406.7	NW

Table 3.5-4 Public Water Supplies (PWS) within 1 mile of the Project Centerline

County	Approximate Mile Post Marker	Distance From CL (feet)	Cardinal Direction from CL
Harris	45.2	3585.5	NW
Harris	45.2	4117.9	NW
Harris	45.2	4113.5	NW
Harris	45.2	4214.6	NW
Harris	45.2	3837.9	NW
Harris	45.2	4441.0	NW
Harris	45.2	3987.0	NW
Harris	45.3	3956.6	NW
Harris	45.3	4422.7	NW
Harris	45.3	4408.9	NW
Harris	45.3	4051.6	NW
Harris	45.3	4051.6	NW
Harris	45.3	4512.5	NW
Harris	45.3	4618.5	NW
Harris	45.3	4606.1	NW
Harris	45.3	4712.1	NW
Harris	45.3	4828.6	NW
Harris	45.3	4824.8	NW
Harris	45.3	4820.3	NW
Harris	45.3	5030.7	NW
Harris	45.3	5049.7	NW
Harris	45.3	4028.9	SE
Harris	45.3	4028.9	SE
Harris	45.3	3056.0	SE
Harris	45.3	3624.4	NW
Harris	45.3	2622.0	SE
Harris	45.3	3758.6	NW
Harris	45.5	1106.4	SE
Harris	45.5	2083.1	NW
Harris	45.5	4785.3	SE
Harris	45.5	4372.7	SE
Harris	45.6	3945.0	SE
Harris	45.6	3843.7	SE
Harris	45.7	1303.3	SE
Harris	45.7	1303.3	SE
Harris	45.7	4963.3	SE
Harris	45.7	2371.6	SW
Harris	45.7	990.6	SE
Harris	45.7	1896.1	SE
Harris	46.0	1522.4	SE
Harris	46.1	1522.4	SE

Table 3.5-4 Public Water Supplies (PWS) within 1 mile of the Project Centerline

County	Approximate Mile Post Marker	Distance From CL (feet)	Cardinal Direction from CL
Harris	46.6	1669.6	NE
Harris	46.7	2073.0	NW
Harris	46.8	2107.5	NW
Harris	47.2	2889.3	NW

3.5.5 Floodplains

From a geomorphic perspective, floodplains are relatively low, flat areas of land that surround waterbodies and hold overflows during flood events. Floodplains are often associated with rivers and streams, where they consist of stream deposited sediments forming levels (or “terraces”) deposited at different times along the watercourse.

From a policy perspective, Federal Emergency Management Agency (FEMA) defines a floodplain as being any land area susceptible to being inundated by waters from any source (FEMA 2005). Much of the basic inventory, regulation, and mitigation effort for floodplains and flood mitigation (including the National Flood Insurance Program [NFIP]) are led by FEMA. EO11988, Floodplain Management, states that actions by federal agencies shall avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplain development wherever there is a practicable alternative. Each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for: (1) acquiring, managing, and disposing of federal lands, and facilities; (2) providing federally undertaken, financed, or assisted construction and improvements; and (3) conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

Within the Project area, low terraces occur at nearly every stream crossing. For smaller intermittent and ephemeral drainages, these are typically narrow and infrequently flooded. At crossings of rivers and larger perennial streams, floodplains are wider and may be more frequently flooded to a particular elevation depending on the magnitude of a given flood. Zones of major interest from a regulatory floodplain perspective are indicated on Table 3.5-5.

Three pump stations along the Gulf Coast route are located within a 100 year floodplain. Pump Station 39 at MP 333.2 in Cherokee County, Texas is located in the Angelina River floodplain. Pump Station 40 at MP 383.3 in Polk County, Texas is located in the Big Sandy Creek floodplain. Pump Station 41 at MP 431.9 in Liberty County, Texas is located within the Batiste Creek floodplain.

3.5.5 Wetlands and Riparian Areas

Wetlands and riparian areas were identified along the Project by completing field surveys and reviewing aerial photographs for areas where reroutes were developed. Wetlands and Waters of the US along the proposed route were delineated in accordance with the direction provided by the US Army Corps of Engineers (USACE) – Omaha, Kansas City, Tulsa, Fort Worth, and Galveston districts. Specific information regarding: discussions with the USACE districts’ personnel, level of effort, wetland and Waters of the US delineation methodology, and permitting requirements will be submitted to the lead federal agency.

In addition to collecting sufficient data for "routine on-site delineations" as per the USACE Wetlands Delineation Manual (USACE 1987) and channel characteristics data for drainage crossings, wetland survey teams collected sufficient data (e.g., defined bed and bank and connectivity to navigable waters) for the USACE to make jurisdictional determinations for all wetlands and drainage crossings surveyed in the field.

Wetland and riverine communities crossed by the proposed pipeline are summarized in Table 3.5-6. Wetlands and riverine habitats occupy less than 4.2 percent of the proposed pipeline route. Of this, most is in Texas. The majority--78.2 percent--of the wetlands crossed are characterized as Palustrine Emergent, Palustrine Forested, and Palustrine Scrub Shrub, which includes classifications such as marshes, bogs, and prairie potholes. The remaining 27.8 percent are riverine or areas that are contained within a channel. A portion of the palustrine wetlands crossed by the proposed ROW is identified as farmed wetlands. A number of wetland areas are located in actively grazed rangeland.

The most common types of wetlands found along the proposed ROW are palustrine emergent and palustrine forested wetlands. Palustrine emergent wetlands are dominated by perennial rooted herbaceous vegetation, while palustrine forested wetlands are dominated by woody species greater than 20 feet in height. Common wetland species identified along the pipeline route are included in Section 3.6, Table 3.6-1.

Table 3.5-5 Significant Floodplains Along the Proposed Route

State	Approximate Milepost	Watercourse Associated with Floodplain
Steele City Segment		
Montana		
Valley	82.5 - 84.9	Milk River
Valley/McCone	86.9 – 90.0	Missouri River
McCone	146.1 – 146.8	Redwater River
Dawson	194.8 – 196.0	Yellowstone River
South Dakota		
Harding	291.1 – 291.9	Little Missouri River
Meade/Pennington	424.5 – 425.6	Cheyenne River
Haakon	480.3 – 481.0	Bad River
Lyman/Tripp	535.1 – 535.9	White River
Nebraska		
Nance	738.4 – 739.8	Loup River
Merrick	754.1 – 756.5	Platte River
Gulf Coast Segment		
Oklahoma		
Creek	20.0-20.1	Tributary to Deep Fork
Creek	21.8-22.1	Deep Fork
Creek	22.4-23.6	Deep Fork
Okfuskee	23.6-23.7	Deep Fork
Okfuskee	38.7-39.1	North Canadian River
Seminole	39.1-39.3	North Canadian River
Seminole	43.7-44.0	Sand Creek
Seminole	58.4-59.1	Wewoka Creek
Hughes	59.1-59.2	Wewoka Creek
Hughes	59.8-60.4	Jacobs Creek
Hughes	74.2-74.9	Canadian River
Coal	86.6-87.4	Muddy Boggy Creek
Atoka	125.7-127.6	Clear Boggy Creek
Atoka	130.3-130.9	Cowpen Creek

Table 3.5-5 Significant Floodplains Along the Proposed Route

State	Approximate Milepost	Watercourse Associated with Floodplain
Bryan	154.7-154.8	Red River
Texas		
Nacogdoches	314.8 – 315.3	Angelina River
Nacogdoches	318.4 – 318.4	Angelina River
Nacogdoches	318.9 – 319.0	Angelina River
Nacogdoches	324.0 – 324.5	Angelina River
Nacogdoches	332.0 – 332.2	Angelina River
Angelina	340.0 – 340.1	Red Bayou
Angelina	340.4 – 340.5	Red Bayou
Angelina	342.8 – 342.8	Watson Branch
Angelina	345.4 – 345.5	Neches River
Angelina	345.5 – 347.2	Neches River
Angelina	348.7 – 349.0	Neches River
Angelina	349.7 – 350.8	Neches River
Angelina	350.8 – 351.2	Neches River
Angelina	356.2 – 356.2	Neches River
Angelina	356.6 – 356.6	Neches River
Angelina	357.8 – 359.0	Hurricane Creek
Angelina	360.2 – 360.3	Neches River
Angelina	360.5 – 360.6	Neches River
Angelina	360.9 – 362.0	Neches River
Angelina	363.4 – 364.4	Neches River
Angelina	364.5 – 365.9	Neches River
Polk	365.9 – 368.2	Neches River
Polk	371.8 – 371.8	Piney Creek
Polk	372.0 – 372.0	Piney Creek
Polk	372.3 – 372.9	Piney Creek
Polk	373.3 – 374.1	Neches River
Polk	374.1 – 374.1	Neches River
Polk	378.7 – 378.8	Brushy Creek
Polk	379.0 – 379.1	Kennedy Creek
Polk	380.6 – 380.7	Johnson Creek
Polk	385.9 – 386.0	Big Sandy Creek
Polk	387.7 – 388.0	Big Sandy Creek
Polk	389.1 – 389.2	Big Sandy Creek
Polk	393.3 – 393.4	Menard Creek
Polk	400.2 – 400.7	Menard Creek
Polk	403.0 – 403.2	Dry Branch
Liberty	412.2 – 412.4	Menard Creek
Liberty	430.7 – 432.1	Batiste Creek
Liberty	435.2 – 435.6	Batiste Creek

Table 3.5-5 Significant Floodplains Along the Proposed Route

State	Approximate Milepost	Watercourse Associated with Floodplain
Hardin	436.6 – 436.9	Batiste Creek
Hardin	437.3 – 437.5	Batiste Creek
Hardin	444.9 – 445.5	Pine Island Bayou
Hardin	445.5 – 446.4	Pine Island Bayou
Liberty	447.3 – 447.9	Pine Island Bayou
Jefferson	449.3 – 450.4	Pine Island Bayou
Jefferson	453.7 – 454.3	Cotton Creek
Jefferson	460.7 – 460.9	North Fork Taylor Bayou
Jefferson	461.4 – 461.5	North Fork Taylor Bayou
Jefferson	463.7 – 463.8	Willow Marsh Bayou
Jefferson	463.9 – 464.6	Willow Marsh Bayou
Jefferson	464.9 – 468.5	Willow Marsh Bayou
Jefferson	468.9 – 469.4	Willow Marsh Bayou
Jefferson	469.9 – 470.7	Willow Marsh Bayou
Jefferson	476.9 – 477.1	Neches River

No floodplains identified are within 5 miles of new pump station sites along the Keystone Cushing Extension. Three pump stations are located within a floodplain, including Pump Station 39 1 at MP 333.25 in Cherokee County, Texas, Pump Station 40 2 at MP 383.35 in Polk County, Texas, and Pump Station 41 1 at MP 431.96 in Liberty County, Texas

Table 3.5-6 Miles of Wetlands Crossed by the Project

State	Wetland Types Crossed (miles)				
	Palustrine Emergent	Palustrine Forested	Riverine/ Open Water/	Palustrine Scrub Shrub	TOTALS
NWI Codes	PEM	PFO	ROW	PSS	
MT	1.0	0.2	3.5	<0.1	4.7
SD	1.6	0.0	4.2	<0.1	5.8
NE	5.8	0.1	1.7	<0.1	7.6
KS	0.0	0.0	0.0	0.0	0.0
OK	0.4	0.2	1.2	0.1	1.9
TX	4.8	14.7	2.1	0.9	24.4
Keystone XL Project Total	**13.6**	**15.2**	**12.7**	**1.0**	**44.4**

[1]Delineations were based on field surveys wherever possible. Where surveys were not conducted, a combination of national data coverage (e.g., NWI) and aerial interpretation was used. Workspace locations do not reflect environmental survey results.

3.6 Terrestrial Vegetation

3.6.1 Vegetative Types

Vegetative types that occur along the Project route were identified and delineated based on review of literature, internet database resources, interpretation of aerial photography, general observations made during field reconnaissance activities, and detailed information collected during wetland and waters of the US delineation activities. Descriptions of these vegetation types and subtypes, includine common species, are included in Table 3.6-1.

Grassland/rangeland, upland forest, palustrine emergent wetland, shrub-scrub wetland, palustrine forested wetland, streams, and open water areas support naturally occurring terrestrial and aquatic vegetation whereas residential and commercial/industrial areas primarily include artificially created landscapes with minimal naturally occurring vegetation. Cropland and pivot-irrigated cropland areas primarily include introduced crop species, which provide forage and grain for livestock and human consumption. Areas of existing ROW consist of previously disturbed areas associated with pipelines and other utilities that have been reclaimed primarily with native herbaceous species and may include some introduced species. Table 3.6-2 provides the approximate mileages of the various vegetation types crossed by the proposed route.

Steele City Segment

Montana

In Montana, the Project route crosses through the Northwestern Great Plains and the Northwestern Glaciated Plains Ecoregions (Woods et al. 2002). Within these ecoregions the Project crosses five sub-ecoregions: Central Grasslands, Glaciated Northern Grasslands, Missouri Plateau, River Breaks, and Cherry Patch Moraines. The Central Grasslands and Glaciated Northern Grasslands are the two dominant areas crossed by the Project. These two sub-ecoregions are plains dissected by many small, ephemeral or intermittent streams. Native vegetation communities consist of grasslands dominated by grama species (*grama* spp.), green needlegrass (*Nassella viridula*), needle-and-thread grass (*Hesperostipa* spp.) and western wheatgrass (*Pascopyrum smithii*). Land use consists of rangeland with some farmland in the Yellowstone Valley of the Central Grasslands and the Milk River Valley of the Glaciated Northern Grasslands.

The Missouri Plateau is composed of treeless, rolling hills and benches that were mostly unmodified by continental glaciation. The soils are derived from residuum, and support native vegetative communities of western wheatgrass and green needlegrass. Rangeland and farmland are the dominant land uses.

The River Breaks sub-ecoregion is found around the Yellowstone and Missouri Rivers. This area is characterized by highly dissected terraces and uplands, and steeply sloped, heavily wooded draws found along the two rivers. Native vegetation communities range from sparsely vegetated areas composed of western wheatgrass in bottomland areas, to threadleaf sedge (*Carex filifolia*), and needle and thread grasses on hillslopes, to junipers and deciduous trees in the draws. The area is largely ungrazed and uncultivated due to heavy sticky soils, lack of water for livestock, and the rugged topography. The Cherry Patch Moraines sub-ecoregion is found at the northern portion of the Project. It extends into Canada and has many seasonal lakes and wetlands. Native vegetation communities consist of shortgrass prairie. Grazing and farming occur in the area.

The vegetative community types crossed by the Steele City Segment of the Project are primarily grasslands/rangeland and agriculture.

Table 3.6-1 Vegetation Types Crossed by the Project

General Vegetation Type	Subclass Vegetation	General Description	Common Species	Occurrence Along ROW by State						
				Steele City Segment			Keystone Cushing Extension Pump Stations	Gulf Coast Segment		Houston Lateral
				MT	SD	NE	KS	OK	TX	TX
Agriculture	Cropland	• Actively cultivated land • Row crops • Hayfields	Wheat, barley, oats, sorghum, corn, beans, hay	X	X	X		X	X	X
	Center Pivot Irrigated Cropland	• Land cultivated by center pivot		X	X	X	X			
	Hay meadows							X	X	
Previously Disturbed	Residential	Suburban residential areas	Ornamental trees, shrubs	X	X	X	X	X	X	X
	Commercial	Commercial development areas		X	X	X	X	X	X	X
	Industrial	• Electric power and gas utility stations • Roads • Landfills • Mines • Wind farms, etc.		X	X	X	X	X		
	ROW	Roads, railroads and utility corridors	Mixture of grasses and forbs	X	X	X	X	X		

Table 3.6-1 Vegetation Types Crossed by the Project

General Vegetation Type	Subclass Vegetation	General Description	Common Species	Occurrence Along ROW by State: Steele City Segment MT	Steele City Segment SD	Steele City Segment NE	Keystone Cushing Extension Pump Stations KS	Gulf Coast Segment OK	Gulf Coast Segment TX	Houston Lateral TX
Grassland/ Rangelands	Tall Grass Prairie	Grassland community dominated by tall grasses 3 to 6 feet tall	Big Bluestem (*Andropogon gerardii*), Little Bluestem (*Schizachyrium scoparium*), Indian Grass (*Sorghastrum nutans*)	X	X	X	X	X		X
	Mid-Grass Prairie	Grassland community dominated by grasses approximately 1 to 2 feet tall	Blue Grama (*Bouteloua gracilis*), Needle and Thread (*Hesperostipa comata*), Green Needlegrass (*Nassella viridula*), Western Wheatgrass (*Pascopyrum smithii*)					X		X
	Short Grass Prairie	Grassland community generally dominated by grasses less than 1 foot tall	Blue Grama (*Bouteloua gracilis*), Buffalograss (*Buchloe dactyloides*)			X				

Table 3.6-1 Vegetation Types Crossed by the Project

General Vegetation Type	Subclass Vegetation	General Description	Common Species	Occurrence Along ROW by State						
				Steele City Segment			Keystone Cushing Extension Pump Stations	Gulf Coast Segment		Houston Lateral
				MT	SD	NE	KS	OK	TX	TX
	Sand Hills Dune Prairie	Grassland community on sand or gravel soils, dominated by sand-adapted grasses	Sand Bluestem (*Andropogon hallii*), Hairy Grama (*Bouteloua hirsuta*), Prairie Sandreed (*Calamovilfa longifolia*), Little Bluestem (*Schizachyrium scoparium*)		X	X				
	Non-native Grassland	Pasturelands planted with non-native cool-season grasses	Fescue (*Festuca* spp.), Smooth Brome (*Bromus inermis*), and other seed pasture grasses					X	X	X
	Deciduous Shrubland	Upland or lowland communities dominated by shrubs	Chokecherry (*Prunus virginia*), Sandbar Willow (*Salix interior*), Silver Buffaloberry (*Shepherdia argentea*), Western Snowberry (*Symphoricarpos occidentalis*)					X	X	X
	Conservation Reserve Program	Mixed native and non-native grasses and forbs. May include shrubs. Land is fallow	A variety of native and introduced grass species		X	X			X	X
	Mixed Prairie	Prairie grasses of mixed heights	Grama (*Bouteloua* spp.), Little Bluestem (*Schizachyrium					X		

Table 3.6-1 Vegetation Types Crossed by the Project

General Vegetation Type	Subclass Vegetation	General Description	Common Species	Occurrence Along ROW by State: Steele City Segment MT	Steele City Segment SD	Steele City Segment NE	Keystone Cushing Extension Pump Stations KS	Gulf Coast Segment OK	Gulf Coast Segment TX	Houston Lateral TX
			scoparium)							
	Bluestem Grasslands	Evident over much of the Gulf Prairies and Marshes	Bushy Bluestem (*Andropogon glomeratus*), Little Bluestem (*Schizachyrium tenerum*), Silver Bluestem (*Bothriochloa saccaroides*), Bermuda Grass (*Cynodon dactylon*)					X		
Upland Forest	Deciduous Forest	Forests dominated by a wide variety of mixed native and non-native deciduous species	Green Ash (*Fraxinus pennsylvanica*), Quaking Aspen (*Populus tremuloides*), Bur Oak (*Quercus macrocarpa*), American Elm (*Ulmus americana*), Hickory (*Carya* spp.), Boxelder (*Acer negundo*), Hackberry (*Celtis occidentalis*)	X	X	X		X	X	X
	Post Oak Woods/Forest/ Grassland Mosaic	Most apparent on the sandy soils of the Post Oak Savannah.	Blackjack Oak (*Quercus marilandica*), Eastern Redcedar (*Juniperus virginiana*), Mesquite (*Prosopis glandulosa*), Black Hickory (*Carya texana*), Yaupon (*Ilex*					X	X	X

Table 3.6-1 Vegetation Types Crossed by the Project

General Vegetation Type	Subclass Vegetation	General Description	Common Species	Occurrence Along ROW by State: Steele City Segment MT	SD	NE	Keystone Cushing Extension Pump Stations KS	Gulf Coast Segment OK	TX	Houston Lateral TX
			vomitoria), Little Bluestem (*Schizachyrium scoparium*), Three Awn (*Aristida* sp.), Silver Bluestem (*Bothriochloa saccharoides*)							
	Loblolly Pine - Sweetgum	Occurs throughout the Pineywoods	Shortleaf Pine (*Pinus echinata*), Water Oak (*Quercus nigra*), Blackgum (*Nyssa sylvatica*), Winged Elm (*Ulmus alata*)					X	X	
	Mixed Forest	Forest composed by a wide variety of mixed deciduous and evergreen species, neither deciduous nor evergreen species are greater than 75 percent of total tree cover.	Junipers (*Juniperus* spp), Pines (*Pinus* Spp.), Green Ash (*Fraxinus pennsylvanica*), Quaking Aspen (*Populus tremuloides*), Bur Oak (*Quercus macrocarpa*)	X						
Riverine/ Open Water	Open Water	Open water, sometimes associated with wetland habitat	N/A	X	X	X		X	X	X
	Riverine Wetlands	Wetlands contained within a channel							X	X
Palustrine Forested	Riparian or Floodplain	Temporarily flooded	Green Ash (*Fraxinus pennsylvanica*),			X				

Table 3.6-1 Vegetation Types Crossed by the Project

General Vegetation Type	Subclass Vegetation	General Description	Common Species	Occurrence Along ROW by State						
				Steele City Segment			Keystone Cushing Extension Pump Stations	Gulf Coast Segment		Houston Lateral
				MT	SD	NE	KS	OK	TX	TX
Wetlands	Woodland	woodlands	Eastern Cottonwood (*Populus deltoides*), Bur Oak (*Quercus macrocarpa*), American Elm (*Ulmus americana*)							
	Cottonwood Floodplain Woodland	Floodplain forest dominated by cottonwood species	Green Ash (*Fraxinus pennsylvanicus*), Eastern Cottonwood (*Populus deltoides*), Willow (*Salix* spp.)	X	X	X				
	Bald Cypress-Water Tupelo Swamp	Swampy flatlands in the Pineywoods	Water Oak (*Quercus nigra*), Water Hickory (*Carya aquatica*), Swamp Blackgum (*Nyssa sylvatica* var. *biflora*), Swamp Privet (*Fraxinus caroliniana*)					X	X	X
Palustrine Emergent/ Scrub-Shrub Wetlands	Palustrine or Emergent Wetlands	Temporary, seasonal, or semipermanent wetlands dominated by persistent emergent vegetation	Common Spikerush (*Eleocharis palustrisi*), Rush (*Juncus* spp.), Rice Cutgrass (*Leersia oryzoides*), Bulrush (*Schoenoplectus* spp.), Bur-reed (*Sparganium* spp.), Cattail (*Typha* spp.), Sedge (*Carex* spp.)	X	X	X		X	X	X

Table 3.6-1 Vegetation Types Crossed by the Project

General Vegetation Type	Subclass Vegetation	General Description	Common Species	Occurrence Along ROW by State						
				Steele City Segment			Keystone Cushing Extension Pump Stations	Gulf Coast Segment		Houston Lateral
				MT	SD	NE	KS	OK	TX	TX
	Riparian Shrubland	Temporarily flood shrub community	Sedge (*Carex* spp.), Willow (*Salix* spp.), Bulrush (*Schoenoplectus* spp.), Western Snowberry (*Symphoricarpos occidentalis*)		X	X				
	Aquatic Bed Wetland	Intermittently, temporarily, or permanently flooded wetlands	Inland Saltgrass (*Distichlis spicata*), Western Wheatgrass (*Pascopyrum smithii*), Smartweed and Knotweed (*Polygonum* spp.), Pondweed (*Potamogeton* spp.)			X				

Grassland/Rangeland

Grasslands found in the Project area are predominantly mixed grass prairie, with a small amount of short grass prairie in the northern portion. Shrubland habitats were also included in this category and consist of sagebrush communities. Mixed grass prairie typically is composed of a mix of tall, short and intermediate grass species such as blue grama (*Bouteloua gracilis*), green needlegrass, thickspike wheatgrass *(Elymus lanceolatu)*, and western wheatgrass (MNHP 2008). Silver sagebrush occupies relatively mesic sites, and is generally found on the upper floodplain terraces of the larger creeks in the Project area. Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) also occurs in some small, sparse stands throughout the study area. Silver buffaloberry (*Shepherdia argentea*) occurs as small, isolated patches in protected draws, drainage heads, and swale bottoms.

Agriculture

Agricultural lands are located throughout the majority of the Project area usually in areas with gently rolling hills and plains. The majority of the agricultural crops are either hay (i.e., areas of grasses, legumes, or grass-legume mixtures) or cultivated crop (i.e., areas used for production of annual crops such as corn, soybeans, etc.) (USGS 2004).

Previously disturbed

Previously disturbed areas include residential, commercial, industrial, ROW corridors and barren areas. Vegetation in previously disturbed areas is frequently little to none, and is often composed of introduced weedy species. Residential areas typically include housing units, parks, golf course, and vegetation planted in development settings for recreation, erosion control, or aesthetic purposes. Commercial and industrial areas include stores, office buildings, roads, and landfills. These areas typically have planted vegetation for erosion control or aesthetic purposes. The majority of the surface is composed of impervious surfaces. ROW corridors include roads, utility corridors and railroads. These areas are often replanted with a mixture of grasses and forbs. Barren areas include gravel quarries, sparsely vegetated areas, and rock outcrops.

Upland Forest

Upland forests in Montana are natural or semi-natural woody vegetation, generally greater than 6 meters tall where tree canopy accounts for 25-100 percent of the cover (USEPA 2008a). Most of the upland forests are found along stream and rivers, in rugged topography or where rolling hills are dissected by drainages. Forest communities are either deciduous or mixed forest (forests composed of a deciduous and evergreen species). Common deciduous tree species in both types include green ash (*Fraxinus pennsylvanica*), burr oak (*Quercus macrocarpa*), and quaking Aspen (*Populus tremuloides*). Evergreen species are commonly junipers (*Juniperus sp*.) and pine species (*Pinus* spp.)

Wetlands/Riparian Areas

Within the region, wetlands and riparian areas are limited in extent and usually found along shallow to deeply incised landforms associated with drainages. Riparian areas as defined by the NRCS and USDA (GM 190.411,-Part 411) as areas with unique soil and vegetation characteristics between terrestrial and aquatic ecosystems. Included in this definition are wetlands, and those portions of floodplains and valley bottoms that support riparian vegetation. The riparian areas provide critical vegetation and transportation corridors for mammals, birds, and amphibians; maintain water quality, stabilize stream banks, provide flood control and aesthetic values (USDA, NRCS 2008b).

Wetlands within the Project areas were classified into three categories palustrine emergent wetlands (PEM), palustrine scrub-shrub wetlands (PSS), and palustrine forested wetlands (PFO). In PEM wetlands fowl blue grass (*Poa palustris)* and fox tail *(Hordeum jubatum)* dominate areas that typically contain water for several

weeks after spring snowmelt. Shallow-marsh vegetation such as spikerush (*Eleocharis palustris)* and wheat sedge *(Carex antherodes*) dominate areas where water typically persists for a few months each spring, and deep-marsh vegetation like cattails (*Typha latifolia*), and hardstem bulrush *(Scirpus acutus*) occupies areas where water persists throughout the year.

PSS wetlands are dominated by woody vegetation less than 5 meters in height. The species present could be true shrubs, young trees, or trees that are stunted due to environmental conditions. Common PSS species may include greasewood (*Sarcobatus*), winterfat *(Krascheninnikovia lanata),* fourwing saltbush (*Atriplex canescens*), and shadscale saltbush (*Atriplex confertifolia*).

PFO wetlands are dominated by woody vegetation greater than or equal to 5 meters in height. Common PFO species include: boxelder (*Acer negundo*) eastern cottonwood (*P. deltoides*) peachleaf willow (*Salix amygdaloides*) gray alder (*Alnus incana*), water birch (*Betula occidentalis*), redosier dogwood (*Cornus sericea*), chokecherry (*Prunus virginiana*), skunkbush sumac (*Rhus trilobata*), Drummond's willow (*Salix drummondiana*), narrowleaf willow (*Salix exigua*), shining willow (*Salix lucida*), silver buffaloberry (*Sheperdia argentea*), and snowberry species (*Symphoricarpos* spp.). Exotic species of tamarisk species (*Tamarix* spp.) and Russian olive (*Elaeangus angustifolia*) are common within these stands. All wetland types must consist of vegetation coverage greater than 20% (USDA NRCS 2008; USEPA 2008a; USGS 2004).

South Dakota

In South Dakota, the majority of the Project area is located in the Northwestern Great Plains ecoregion, with only a small portion of the Project in the Northwestern Glaciated Plains in the southern part of the state. In these two ecoregions, the Project crosses seven sub eco-regions: Missouri Plateau, River Breaks, Sagebrush Steppe, Subhumid Pierre Shale Plains, Moreau Prairie, Ponca Plains and Southern River Breaks. The Missouri Plateau and River Breaks sub eco-regions are similar as described above for the Montana portion of the route.

The Sagebrush Steppe sub eco-region is found on the northwestern corner of South Dakota. It is an arid area with rugged topography composed of eroded buttes, Hell Creek badlands, scoria mounds and salt pans. Vegetation is typically shortgrass prairie and sagebrush communities. Due to the lack of rainfall, and topography, the area has minimal cultivation and a low human population. Wildlife is relatively abundant. The Subhumid Pierre Shale Plains sub eco-region is the dominant sub eco-region crossed by the Project. Vegetation consists of mixed grass prairie with a predominance of shortgrass species including little bluestem (*Schizachyrium scoparium*) and buffalo grass (*Bouteloua dactyloides*). Due to soft, black shale soils with a high risk of erosion when tilled, cultivation is infrequent.

The Moreau Prairie sub eco-region is found along the Moreau River. It is less rugged than the Sagebrush Steppe, but still has occasional buttes, areas of badlands, and numerous salt pans. The soils tend to be alkaline, lowering cropfield production. Cattle, sheep and antelope grazing occur in most of the region. The Ponco Plains and Southern River Breaks only occur on a small portion of the Project route, near the South Dakota and Nebraska border. These two sub eco-regions are found along the transition from the densely settled farmland to the East of the Missouri to the rangeland west of the river.

The Project crosses five vegetation types in South Dakota: agriculture, previously disturbed, grassland/rangeland, upland forest, and wetland/riparian areas. Agriculture and previously disturbed areas are similar to those as described above for the Montana portion of the Project. Grassland/Rangeland is composed of mixed grass prairie and sand hills dune prairie community types. The mixed grass prairie is the same as seen in the Montana portion of the line. The Sand Hills Dune Prairie is a perennial grassland found on sand or gravel soils. In South Dakota and Nebraska, these grasslands are found on wind formed sand dunes, with groundwater lakes and marshes between the dunes. Typical species are sand bluestem Sand Bluestem (*Andropogon hallii*), Hairy Grama (*Bouteloua hirsuta*), Prairie Sandreed (*Calamovilfa longifolia*), and Little Bluestem (See Nebraska Sand Hills Section 3.6.2.2). Upland forest communities are deciduous forest

communities with typical species consisting of green ash, quaking aspen, burr oak, and hickory (*Carya* spp.). Wetland/riparian areas are similar to those in Montana.

Nebraska

In Nebraska, the Project crosses three ecoregions: the Central Great Plains, Northwestern Great Plains, and the Nebraska Sand Hills. Dominant sub-ecoregions include the Rainwater Basin Plains, Central Nebraska Loess Plains, Platte River Valley, Wet Meadow and Marsh Plain, and Sand Hills. Smaller eco-regions include the Keya Paha Tablelands, Smoky Hills and Niobrara River Breaks. The Nebraska Sand Hills are described in Section 3.6.2.2 and include the sub eco-regions of the Wet Meadows and Marsh Plains and the Lake Area. The Keya Paha Tablelands and Niobrara River Breaks are found just south of the South Dakota/Nebraska border and only cover a small portion of the route. These areas are semiarid with rolling topography. Agriculture is limited due to the lack of regular precipitation. The Niobrara River Breaks area is a mix of prairie communities and woody vegetation along the river valley, which provide excellent wildlife habitat.

The Rainwater Basin Plains are found in the southern part of the state and is described in Section 3.6.2.1. The Central Nebraska Loess Plains is found in the central portion of the state. The rolling, dissected plains of this sub eco-region support a mixed grass prairie community with shortgrass species such as blue grama and buffalograss, intermediate grasses such as side-oats grama (*Bouteloua curtipendula*), little bluestem, western wheatgrass, and sand dropseed, and tallgrass prairie species such as big bluestem (*Andropogon gerardii*), Indiangrass (*Sorghastrum nutans*), and switchgrass (*Panicum virgatum*). Land use in the area consists of cropland and rangeland. The Platte River Valley sub eco-region is a flat wide alluvial valley found along the Platte River. The substrate is alluvial sand and silty soils. Land use is cultivated cropland, mostly consisting of center pivot irrigation and urban areas. Flood control along the river and extensive water withdrawal for irrigation have limited seasonal flooding and allowed the growth of hardwood trees in the valley. The Smoky Hills Ecoregion is at the southern border between Nebraska and Kansas. It is a transitional ecoregion between the tallgrass prairie found to the east, and the mixed grass prairie to the west. The climate and native vegetation are variable. Land use consists of cropland and rangeland. Dryland winter wheat is the principal crop.

The vegetative community types crossed by the Project are agriculture, previously disturbed, grassland/rangeland, upland forest, and wetland/riparian areas. Agriculture and previously disturbed areas are similar to those as described above for the Montana portion of the Project. Grassland/Rangeland vegetative community types in the Nebraska portion of the Project are Tall Grass Prairie, Mixed Grass Prairie and Sand Hills Dune Prairie. The Mixed Grass Prairie and Sand Hills Dune Prairie are the same as described above for Montana and South Dakota. The Tall Grass Prairie is composed of grass species three to five feet tall. Typical species include big bluestem, little bluestem, Indian grass, switchgrass, and Canada wildrye (*Elymus canadensis*). Upland forest communities are similar to those described above for the Montana and South Dakota portions of the line. Wetland/riparian areas are similar to those described above, except for the addition of aquatic bed wetlands. Aquatic bed wetlands are dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. For optimum growth the vegetative communities require relatively permanent water or repeated flooding. Typical species include Inland Saltgrass (*Distichlis spicata*), Pondweed (*Potamogeton* spp.), knotweed species (*Polygonum* spp.), and algae.

Table 3.6-2 Miles of Vegetative Communities Crossed by the Project ROW

State	Vegetative Communities Crossed (miles)								
	Agriculture	Previously Disturbed	Grassland/ Rangeland	Upland Forest	Riverine/Open Water	Palustrine Forested Wetlands	Palustrine Emergent Wetlands	Scrub-Shrub Wetlands	TOTAL
Montana – Steele City Segment	72.8	3.1	200.9	0.7	3.5	0.2	1.0	<0.1.	282.3
South Dakota – Steele City Segment	80.6	3.0	222.6	0.8	4.2	0.0	1.6	<0.1	312.8
Nebraska – Steele City Segment	116.0	3.8	123.9	3.8	1.7	0.1	5.8	<0.1	255.2
Oklahoma – Gulf Coast Segment	11.2	22.5	97.1	44.7	1.2	0.2	0.4	0.1	154.9
Texas – Gulf Coast Segment	50.6	42.0	96.6	118.9	1.9	7.7	4.7	0.9	323.3
Texas Houston Lateral	1.0	4.7	20.0	14.2	0.2	7.0	0.1	0.0	47.2
PROJECT TOTAL[1]	**332.2**	**79.1**	**738.8.**	**183.1**	**12.7**	**15.2**	**13.6**	**1.0**	**1375.7**

Note: Mileage totals reflect new pipeline construction only. Totals do not reflect point disturbances due to construction of new pump stations along the Keystone Cushing Extension in Kansas.

[1] Discrepancies in totals are due to rounding; Workspace locations do not reflect environmental survey results.

Gulf Coast and Houston Lateral Segment

Oklahoma

The Project crosses through five distinct ecoregions in the state of Oklahoma: Cross Timbers Transition, Northern Cross Timbers, Western Ouachitas, Eastern Cross Timbers, and Northern Post Oak Savannah (Woods et al 2005). These ecoregions are distinguished by physiography, geology, soil profile, climate, vegetation, and land cover and use.

The Cross Timbers Transition (Lincoln County) is characterized by upland forests populated by scattered oaks, hickories, and red cedar (*Juniperus virginiana*). In riparian areas, cottonwood (*Populus deltoides*), willow (*Salix* spp.), elm (*Ulmus* spp.), ash (*Fraxinus* spp.), walnut (*Juglans nigra*), and pecan (*Carya illinoensis*) are common. Land cover and use is usually a mixture of rangeland and cropland. Overgrazing, channelization, and releases of water from flood control reservoirs have promoted channel incision. The Northern Cross Timbers ecoregion (Lincoln, Creek, Okfuskee, Seminole, and Hughes Counties) is characterized by scrubby oak forests, oak savannahs, riparian forests, and prairie openings. Land cover and use is generally characterized by woodland, grassland, rangeland, pastureland, and limited croplands. Abandoned farmland is common and fire suppression and passive land use have allowed the woodland distribution to expand. The Eastern Cross Timbers ecoregion (Bryan County) is characterized by oak savannahs, prairie openings, and bottomland hardwood forests. Land cover and use is typically a mix of grassland, rangeland, woodland, and cropland. The Northern Post Oak Savannah (Bryan County) is characterized by tall grass prairies and cross timbers. In riparian areas, cottonwood, sycamore (*Platanus occidentalis*), willow, elm, and ash occur. Land cover and use

is a mix of cropland, pastureland, and riparian forest. The Western Ouachitas ecoregion (Atoka County) is characterized by loblolly pine *(Pinus taeda*), shortleaf pine *(Pinus echinata),* and oak hickory pine forests on uplands, and southern red oak (*Quercus falcata*), sweetgum (*Liquidambar styraciflua)*, sycamore, white oak *(Quercus alba)*, and shortleaf pine on floodplains. Land cover and use is mostly evergreen or mixed forest and large commercial pine plantations occur. Logging, recreation and woodland grazing are important land uses. Gently sloping sites have been logged much more extensively than steep slopes.

The proposed pipeline crosses five vegetation types in Oklahoma. These vegetation types are: Tallgrass Prairie, Post Oak Blackjack Oak Forest, Bottomland (floodplain), Oak Hickory Forest, and Oak Pine Forest (Duck & Fletcher 1943). The majority of the pipeline route crosses the Post Oak Blackjack Forest, with Bottomland (floodplain) and Tallgrass Prairies intermixed to a lesser extent.

Tallgrass Prairie (Lincoln, Creek, Okfuskee, Seminole, Hughes, Coal, Atoka, Bryan Counties)

Tallgrass Prairie occupies most of the best of the agricultural soils of Oklahoma and, with the exception of the Arbuckle Mountains and Osage areas, is characterized by clean cultivation and low game potential. On the basis of original vegetation, this type includes the big bluestem subtype, the little bluestem subtype, and probably a portion of the eastern edge of the mixed grass ecotone type of Osborn and Whittaker (1936, 1937).

For the most part the natural vegetation consists of a mixture of such species as big bluestem *(Andropogon gerardii)*, little bluestem *(Schizachyrium scoparium)*, Indian grass *(Sorghastrum nutans)*, switch grass *(Panicum virgatum)*, and silver beard grass *(Bothriochloa saccharoides)*, in the eastern portions of the type, with a gradual increase of such species as buffalo grass *(Buchloë dactyloides)*, blue grama *(Bouteloua gracilis)* and side oats grama *(Bouteloua curtipendula)*. Continued grazing removed the tall grass species from the composition of the western portion of the type leaving only the short grasses.

Bottomland (Floodplain) (Lincoln, Creek, Okfuskee, Seminole, Hughes, Coal, Atoka, Bryan Counties)

The Bottomland type includes the first bottom and stream course of all the regular drainage of the state. Due to its statewide consideration there is much variation in the plant composition. In the panhandle and western counties, much of the bottom acreage is devoid of larger permanent vegetation. In places buffalo grass, blue grama, Johnson grass (*Sorghum halepense)*, and river grass (miscellaneous grasses and sedges) form the dominant plant cover. Scattered growths of cottonwoods are common with a few willows and hackberry (*Celtis laevigata* and *C. occidentalis*). Elms enter into the picture more so throughout the central west. Typical stream growth in central Oklahoma within the Tallgrass Prairie type consists of American elm (*Ulmus americana*), chinquapin oak (*Quercus muhlenbergii*), post oak (*Quercus stellata*), blackjack oak (*Quercus marilandica*), hackberry, chittamwood (*Bumelia lanuginosa*), cottonwood, chickasaw plum (*Prunus angustifolia*), fragrant sumac (*Rhus trilobata*), smooth sumac (*Rhus glabra*), and rough leafed dogwood (*Cornus drummondii*). Black oaks (*Quercus velutina*), pecan, sycamore, bitternut (*Carya cordiformis*) and walnut are more common southward and eastward.

There are about 3,400 square miles of bottomland in Oklahoma. Due to the long narrow strips and irregular boundaries of this type, an accurate measurement was difficult. Some of this type exists in every county of the state and on all major streams.

Post Oak Blackjack Oak Forest (Lincoln, Creek, Okfuskee, Seminole, Hughes, Coal, Atoka, Bryan Counties)

The Post Oak Blackjack Oak Forest vegetation type represents the forest-grassland ecotone and contains dominants from both the deciduous formation and the grassland formation. The overstory is largely composed of post oak, blackjack oak, and black hickory *(Carya texana)* with the proportion of blackjack oak increasing as one moves west through the Post Oak Blackjack Oak Forest. The understory is made up of little bluestem, big bluestem, and other species depending upon the site.

Its best correlation with other works is with the Oak Savannah of the Soil Conservation Service. There are approximately 17,600 square miles of this type, including the east central portion of the state with fingers reaching as far west as Cleo Springs in Major County, Curtis in Woodward County, Webb in Dewey County, and western Comanche County. The northeastern portion lying on the north side of the South Canadian, North Canadian, and Cimarron rivers differs importantly from the rest of the Post Oak Blackjack Game Type. This section is supported by deep sandy Quaternary soils.

Oak Hickory Forest (Atoka County)

The Oak Hickory Forest is located largely in the northeastern portion of the state and includes the highlands commonly known as the Ozark Mountains. It is designated as Oak Hickory Forest type by US Soil Conservation Service workers.

The type is characterized by vegetation comprised of such species as blackjack oak, post oak, red oak (*Quercus rubra*), pin oak (*Quercus palustris*), black oak (*Carya texana*), scaly bark hickory (*Carya laciniosa*), pignut hickory (*Carya glabra*), and winged elm (*Ulmus alata*). The ground cover is composed of a mixture of huckleberry (*Vacinium pallidum*), coralberry (*Symphoricarpos orbiculatus*), sassafras, big bluestem, spice bush (*Lindera benzoin)*, bladdernut (*Staphylea trifolia*), hazelnut (*Corylus americana.*), may apple (*Podophyllum peltatum*), bloodroot (*Sanguinaria canadensis)*, and grape (*Vitis aestivalis*). There are approximately 3,713 square miles of this game condition in Oklahoma.

Because of its rugged topography, only 30 percent of this type has been cleared for agricultural purposes, and around 70 percent still stands as woodland. Farms are relatively small in size, averaging 80. The principal crops are corn, cotton, wheat, oats, and hay. Fruits, vegetables, and berries became important cash crops over the last 10 to 15 years. Most farmers keep a small herd of cattle pastured on the open range.

Oak Pine Forest (Atoka County)

The Oak Pine Forest occupies the rugged Ouachita Mountain region in southeastern Oklahoma. Throughout most of the type the shortleaf pine is found in a mixture of various oaks and hickories and, in some areas, rather extensive pure stands of the pine are found. Included in the discussion here are about 120 square miles of the Loblolly Pine Hardwood Game Type in southeastern McCurtain County. Generally this type, as shown by present definition, corresponds with the southern portion of the Oak Hickory Association of Bruner (1931) and the Ouachita Biotic District of Blair and Hubbell (1938). However, it more closely approaches that designated as Oak Pine Forest of the Soil Conservation Service, particularly the map prepared by Thornthwaite.

The more common trees of the combined types are shortleaf yellow pine, loblolly pine, white oak, blackjack oak, post oak, spotted oak *(Quercus shumardii)*, willow oak *(Quercus phellos)*, black locust *(Robinia pseudo-acacia)*, black hickory *(Carya texana)*, basswood *(Tilia americana)*, and sugar maple *(Acer saccharum)*. huckleberry, mock orange *(Philadelphus pubescens)*, pink azelea *(Rhododendron prinophyllum)*, gooseberry *(Ribes* sp.), bladdernut, and spice bush are the more common herbs and shrubs. Big bluestem is common over the entire type, particularly the drier portions.

Texas

The Project route crosses four distinct ecoregions in Texas, including: Oak Woods and Prairies (Lamar, Hopkins, Woods, Franklin, and Smith Counties), Pineywoods (Wood, Smith, Cherokee, Rusk, Nacogdoches, Angelina, Polk, Liberty, Trinity, Hardin, and Harris Counties), Blackland Prairies (Lamar, Delta, and Hopkins Counties), and Gulf Coast Prairies and Marshes (Liberty, Jefferson, and Harris Counties) (Texas Parks and Wildlife 2006).

Thirteen vegetation types are crossed by the proposed route, including: bluestem grasslands, post oak woods/forest/grassland mosaic, willow oak water oak black gum forest, water oak elm hackberry forest, bald cypress water tupelo swamp, young forest/grassland, pine hardwood forest, marsh/barrier island, crops, other

native or introduced grasses and lakes (McMahan et al 1984) (Table 3.6-1). Pine hardwood forests vegetation is found in thirteen of the seventeen counties crossed by the proposed pipeline route. Other native or introduced grasses and young forest/grasslands are found in as many as nine state counties. These three vegetation types encompass the majority of vegetation types crossed by the proposed route in Texas.

Bluestem Grassland

Bluestem grasslands are evident over much of the Gulf Prairies and Marshes. Several bluestem grass species are found in these grassland vegetation types, including: bushy bluestem, slender bluestem, little bluestem and silver bluestem. Three-awn, buffalo grass, Bermuda grass, brownseed paspalum, single-spike paspalum, smutgrass, sacahuista, windmill grass, southern dewberry, live oak, mesquite, huisache, baccaris, and Macartney rose are other common plant species.

Post Oak Woods/Forest/Grassland Mosaic

This vegetation mosaic is most apparent on the sandy soils of the Post Oak Savannah. Blackjack oak, eastern red cedar, mesquite, black hickory, live oak, sandjack oak, cedar elm, hackberry, yaupon, poison oak, American beautyberry, hawthorn, supplejack, trumpet creeper, dewberry, coralberry, little bluestem, silver bluestem, sand lovegrass, beaked panicum, three-awn, sprangle-grass, and tick clover are the most common plant species.

Willow Oak/Water Oak/Blackgum Forest

These forests are found principally in the lower flood plains of the Sulphur, Neches, Angelina, Trinity, and Sabine Rivers in the Pineywoods ecoregion. Plants commonly associated with this vegetation type are beech, overcup oak, chestnut oak, cherrybark oak, elm, sweetgum, sycamore, southern magnolia, white oak, black willow, bald cypress, swamp laurel oak, hawthorn, bush palmetto, common elderberry, southern arrowwood, poison oak, supplejack, trumpet creeper, crossvine, green briar, blackberry, rhomboid copperleaf, and St. Andrew's Cross.

Water Oak Elm Hackberry Forest

This vegetation type occurs in the upper flood plains of the Sabine, Neches, Sulphur, and Trinity Rivers and tributaries. Cedar elm, American elm, willow oak, southern red oak, white oak, black willow, cottonwood, red ash, sycamore, pecan, bois d'arc, flowering dogwood, dewberry, coralberry, dallisgrass, switchgrass, rescue grass, Bermuda grass, eastern gama grass, Virginia wild rye, Johnson grass, giant ragweed, yankeeweed, and Leavenworth eryngo are common plants.

Bald Cypress/Water Tupelo Swamp

This vegetation type is found in the swampy flatlands of the Pineywoods ecoregion. Water oak, water hickory, swamp blackgum, red maple, swamp privit, buttonbush, possum haw, water elm, black willow, eardrop vine, supplejack, trumpet creeper, climbing hempweed, bog hemp, water fern, duckweed, water hyacinth, bladderwort, beggar-ticks, water paspalum and St. John's wort are commonly found plant species.

Young Forest/Grassland

Vegetation mixed of young forest and grasslands are common in the Pineywoods. This vegetation is comprised of various combinations and age classes of pine and regrowth southern red oak, sweetgum, post oak, white oak, black hickory, blackgum, elm, hackberry, and water oak resulting from recent harvesting of pine or pine hardwood forest and the subsequent establishment of young pine plantation or young pine hardwood forests. Shrubs include hawthorn, poison oak, sumac, holly, wax myrtle, blueberry, blackberry, and red bay. This vegetation type also features grasslands resulting from clearing of forests.

Pine Hardwood Forest

Within this vegetation type category, four pine hardwood vegetation subtypes are recognized:

(1) Loblolly Pine Sweetgum

This subtype occurs throughout the Pineywoods and is represented by shortleaf pine, water oak, white oak, southern red oak, winged elm, beech, blackgum, magnolia, American beautyberry, American hornbeam, flowering dogwood, yaupon, hawthorn, supplejack, Virginia creeper, wax myrtle, red bay, sassafras, southern arrowwood, poison oak, greenbriar, and blackberry.

(2) Shortleaf Pine Post Oak Southern Red Oak

This subtype is found in the northeast Texas counties of Bowie, Red River, Lamar, Cass, Camp, Titus, Franklin, Marion, Harrison, Upshur, Gregg, Smith, Wood, and Morris. This subtype pine hardwood vegetation extends into the southeastern Pineywoods along deep sand ridges. Commonly associated plants of this subtype include: loblolly pine, black hickory, sandjack oak, flowering dogwood, common persimmon, sweetgum, sassafras, greenbriar, yaupon, wax myrtle, American beautyberry, hawthorn, supplejack, winged elm, beaked panicum, spranglegrass, Indiangrass, switchgrass, three-awn, bushclover, and tickclover.

(3) Loblolly Pine Post Oak

This subtype is found in the "Lost Pines" of Bastrop County and westward of the pine producing region of East Texas. This pine hardwood vegetation type is not crossed by the route.

(4) Longleaf Pine Sandjack Oak

These forests are found in the southeastern Pineywoods and are commonly represented by loblolly pine, shortleaf pine, blackjack oak, sand post oak, southern red oak, flowering dogwood, sweetgum, sassafras, American beautyberry, wax myrtle, yaupon, hawthorn, yellow Jessamine, slender bluestem, broomsedge bluestem, and little bluestem.

Marsh/Barrier Island

This vegetation type is found in the hydric lowlands of brackish marsh in coastal prairies. Water hyacinth, cattail, water pennywort, pickerelweed, arrowhead, white water lily, cabomba, coontail, and duckweed are commonly found plant species.

Crops

This vegetation type is characterized by cultivated cover crops or row crops providing food and fiber for either human or domestic animals. This type may also represent grassland associated with crop rotations.

Other Native or Introduced Grasses

These grasslands are principally found in northeast, east central, and south Texas. They are typified by mixed native or introduced grasses and forbs on grassland sites or mixed herbaceous communities resulting from the clearing of woody vegetation. This type is associated with the clearing of forests in northeast and east central Texas and may portray early stages of young forest vegetation.

3.6.2 Biologically Unique Landscapes or Ecoregions

3.6.2.2 Rainwater Basin

The Rainwater Basin Complex (RBWC) is 4,200 square miles of wetlands scattered throughout a 17-county area in south central Nebraska. Originally covering a much larger area, only about 10 percent of the RBWC has

not been drained or filled for farmland. Most of the RBWC is now privately owned farmland. The rest is protected and managed by the Nebraska Game and Parks Commission (NGPC) and the US Fish and Wildlife Service (USFWS). The NGPC manages 30 state-owned Wildlife Management Areas, while the US FWS manages 61 federal Waterfowl Production Areas (Rainwater Basin Joint Venture 2008).

The topography is flat to gently rolling, with a poorly developed surface water drainage system that allows many of the watersheds to drain into low lying wetlands (NGPC 2005). The wetlands are shallow, ephemeral depressions that flood quickly during heavy rainstorms and snow melts due to a relatively impervious clay layer lining the depression (US FWS 2005). The area provides resting and feeding areas for more than 300 species of spring migratory birds, including 5 to 7 millions ducks, 6 million snow geese, one million Canada geese, 90 percent of the mid-continent white fronted goose population, and 500,000 sandhill cranes (US FWS 2005; US FWS 2007). It also provides migration habitat for whooping cranes, bald eagles, and other bird species (NGPC 2005). Other common waterfowl observed include northern pintail, green-winged teal, and solitary sandpiper (US FWS 2007).

The RWBC is host to a diverse assemblage of native plant species, which provide spring and fall habitat for migrating birds. Historically, bison and wildfire kept the wetlands open; however, with bison gone and wildfire controlled, management practices are required to keep these wetlands in a condition favored by ducks, geese, and other water birds.

3.6.2.3 Nebraska Sand Hills

The Nebraska Sand Hills cover an area approximately 19,300 mi^2 in north central Nebraska (NGPC 2005). It is the largest grass-stabilized dune region in the Western Hemisphere, and much of the ecoregion remains in a relatively natural state (NGPC 2005). Protected areas within the region include the Crescent Lake/North Platte National Wildlife Refuge Complex in west central Nebraska and the Valentine National Wildlife Refuge Niobrara Valley Preserve and the Fort Niobrara National Wildlife Refuge in north central Nebraska. Very little farming occurs in the region due to the high erosion potential of the dunes. Ranching does occur, with approximately a half million head cattle being grazed in the dunes annually on a rotational grazing system (NPGC 2005).

The area is geographically young, forming sometime in the last 8,000 to 13,000 years after the Pleistocene glaciers receded (NPGC 2005; WWF 2008). The dune soils are poorly developed and have only a thin layer of topsoil. Vegetation consists of two principal vegetation community types – the Sand Hills dune prairie community and the Sand Hills dry valley prairie community (NPGC 2005). The dune prairie community consists of sand-adapted grasses, forbs, and some shrubs. The dry valley prairie community is found between the dunes and consists of tall prairie grasses, forbs, and small shrubs. Other vegetative communities include sparsely vegetated blowouts, native woodlands, wet meadows, and freshwater marshes. The Sand Hills support a diversity of wildlife and provide habitat for migratory birds, resident grassland birds, and breeding waterfowl.

The climate is semiarid with precipitation decreasing from east to west. The precipitation infiltrates quickly into porous sands, continually recharging ground water, including the Ogallala aquifer. The result is a high water table, which supports shallow lakes, freshwater and alkaline wetlands, and marshes. Several rivers drain the area including the North Loup, Middle Loup, Calamus, Cedar and Dismal. The Niobrara River flows through the Sand Hills region from eastern Wyoming into northeastern Nebraska.

3.6.2.4 Native or High-Quality Grasslands

Grasslands that occur along the Project route were identified by examination of aerial photography and observations made during field reconnaissance activities.

Grasslands that occur along the Project were identified by examination of aerial photography and observations made during field reconnaissance activities. Grasslands were defined as areas with primarily grass communities, which can include some shrub-type vegetation. Native or high-quality grasslands in the Project area include areas with a high diversity of primarily native species, which can include some shrub type vegetation, lower quality grasslands have less diversity and frequently include non-native species. In the northern portion of the Project, the primary land use for grasslands is grazing by either livestock or wildlife.

Pastures in the Project area are a mixture of native and improved grasses, and are generally located on the southern portion of the Project. Improved pastures are usually farmed for hay. Native pastures have a 'quality' of low to medium, based on the amount of scattered vegetation found therein. Improved pastures have a 'quality' of medium to high based on the same mentioned criteria.

Consultations were made with the Oklahoma Department of Wildlife Conservation (ODWC) and the Natural Resources Conservation Service (NRCS) in each county crossed by the proposed pipeline route. Results of these meetings revealed that there are no rare, sensitive, threatened or endangered plant species occurring along the Project (Appendix F).

Consultations were also made with Texas Parks and Wildlife Department and the Texas Natural Diversity Database. These consultations revealed that there are no rare, sensitive, threatened or endangered species that occur along the Project (Appendix F).

3.6.3 Sensitive, Rare, Threatened, and Endangered Plant Species

The information presented in this section reflects responses received from appropriate state and federal agencies at the time this document was prepared. This information will continue to be updated throughout the pre-construction process based on continued consultations.

Information on sensitive plant species potentially found along the proposed ROW was obtained from the USFWS, the various state Natural Heritage Programs (NHPs), state wildlife agencies, and field surveys. Federal agencies provided information on special status species. Data on species of special concern or species of concern were provided by the various state wildlife departments. The NHPs provided information on the global status of various plant populations. Habitat, and in some cases species, surveys were conducted in the summer of 2008 along the proposed Project construction ROW for native grassland habitat and for native grassland species. Based upon these information sources, a total of 27 sensitive plants (special status species and species of special concern) were identified as potentially occurring within the Project area. These species, their associated habitats, and their potential for occurrence along the pipeline ROW are listed and summarized in Appendix F, and further discussed in Section 3.7. Occurrence potential along the ROW was evaluated for each plant species based on its habitat requirements and/or known distribution. Based on these evaluations, sensitive plant species, special status species, and species of special concern were eliminated from detailed analysis. The potential occurrences of special status species along each segment of the pipeline ROW are further discussed in Section 3.7 (Special Status Species), and are included in Appendix F.

3.6.4 Noxious and Invasive Weeds

After disturbances to soil, vegetative communities may become susceptible to the colonization of invasive and noxious plant species. These species are most prevalent in areas of prior surface disturbance, such as agricultural areas, roadsides, existing utility ROWs, and wildlife concentration areas. The prevention of the introduction or spread of noxious and invasive weeds is a high priority for nearby communities. Under Executive Order (EO) 13112 of February 3, 1999 – Invasive Species, federal agencies shall not authorize, fund, or carry out actions likely to cause or promote the introduction or spread of invasive species in the US or elsewhere unless it has been determined that the benefits of such actions outweigh the potential harm caused by invasive species and that all feasible and prudent measures to minimize the risk of harm will be taken in conjunction with the actions.

The term “noxious weed” is legally defined under both federal and state laws. Under the Federal Plant Protection Act of 2000 (formerly the Noxious Weed Act of 1974 [7 USC SS 2801-2814]), a noxious weed is defined as “any plant or plant product that can directly or indirectly injure or cause damage to crops, livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment” (USDA Agriculture, Animal, and Plant Health Inspection Service [APHIS] 2000; Institute of Public Law [IPL] 1994). Under EO 13112 of February 3, 1999, an “invasive species” is defined as “an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health” (APHIS 1999). The Federal Plant Protection Act contains a list of 137 federally restricted and regulated federal noxious weeds, including 19 aquatic and wetland weeds, 62 parasitic weeds, and 56 terrestrial weeds (7 CFR Chapter III, Part 360). Each state is required to comply with the rules and regulations set forth by this Act and to manage its lands accordingly.

In addition to federally listed noxious weeds, each state crossed by the proposed route maintains a list of regulated and prohibited noxious and invasive weed species. County weed control boards or districts are present in most counties crossed by the pipeline route. These county weed control boards monitor local weed infestations and provide guidance on weed control. Table 3.6-3 provides a summary of noxious and invasive weeds by state that are known to occur or have the potential to occur along the proposed pipeline route. Noxious weeds that occur widely in areas crossed by the proposed route include: Canada thistle (*Cirsium canadensis*), nodding plumeless thistle (*Cirsium nutans*), leafy spurge (*Euphorbia esula*), diffuse knapweed (*Centaurea diffusa*), purple loosestrife (*Lythrum salicaria*), field bindweed (*Convolvulus arvensis*), Dalmatian toadflax (*Linaria dalmatica*), and Johnson grass (*Sorghum halepense*) (Table 3.6-4).

Table 3.6-3 Noxious and Invasive Weeds Potentially Occurring Along the Proposed Route

			Steele City Segment			Keystone Cushing Extension Pump Station	Gulf Coast Segment		Houston Lateral
Common Name[1]	**Scientific Name[1]**	**Habitat**	**MT[2,8]**	**SD[3]**	**NE[4]**	**KS[5]**	**OK[6,9]**	**TX**	**TX**
Russian knapweed	*Acroptilon repens*	Upland	X	X		X			
Chinese sumac	*Ailianthus altissima*	Upland					X		
Mimosa	*Albizia julibrissin*	Upland					X		
Camelthorn	*Alhagi maurorum*	Upland						X	X
Garlic mustard	*Alliaria petiolata*	Upland					X		
Alligatorweed	*Alternanthera philoxeroides*	Wetland						X	X
Woollyleaf burdock[7]	*Ambrosia grayi*	Upland				X			
Lesser burdock	*Arctium minus*	Upland	X[8]						
Giant reed	*Arundo donax*	Upland						X	X
Hoary alyssum	*Berteroa incana*	Upland	X						
Cheatgrass downy brome	*Bromus tectorum*	Upland					X		
Flowering rush	*Butomus umbellatus*	Wetland	X						
Hedge false	*Calystegia*	Upland						X	X

Table 3.6-3 Noxious and Invasive Weeds Potentially Occurring Along the Proposed Route

			Steele City Segment			Keystone Cushing Extension Pump Station	Gulf Coast Segment		Houston Lateral
Common Name[1]	**Scientific Name[1]**	**Habitat**	**MT[2,8]**	**SD[3]**	**NE[4]**	**KS[5]**	**OK[6,9]**	**TX**	**TX**
bindweed	*sepium*								
Whitetop	*Cardaria draba*	Upland	X	X		X			
Ballon vine	*Cardiospermum halicacabum*	Upland						X	X
Spiny plumeless thistle	*Carduus acanthoides*	Upland	X		X				
Nodding plumeless thistle	*Carduus nutans*	Upland	X		X	X	X		X
White knapweed	*Centaurea diffusa*	Upland	X		X				
Yellow star-thistle	*Centaurea solstitialis*	Upland	X				X		X
Spotted knapweed	*Centaurea stoebe* ssp. *micranthos*	Upland	X		X				
Rush skeleton weed	*Chondrilla juncea*	Upland	X						
Canada thistle	*Cirsium arvense*	Upland, Wetland	X	X	X	X			
Bull thistle[7]	*Cirsium vulgare*	Upland				X			
Poison Hemlock	*Conium maculatum*	Upland	X[8]						
Field bindweed	*Convolvulus arvensis*	Upland	X			X		X	X
Axseed	*Coronilla varia*	Upland					X		
Common crupina	*Crupina vulgaris*	Upland	X						
Dodder	*Cuscuta* spp.	Upland						X	X
Gypsyflower	*Cynoglossum officinale*	Upland, Woodland	X						
Chinese yam	*Dioscorea oppositifolia*	Upland					X		
Common viper's bugloss	*Echium vulgare*	Upland	X						
Brazilian waterweed	*Egeria densa*	Aquatic					X		
Anchored water hyacinth	*Eichhornia azurea*	Aquatic						X	X
Common water	*Eichhornia*	Aquatic						X	X

Table 3.6-3 Noxious and Invasive Weeds Potentially Occurring Along the Proposed Route

			Steele City Segment			Keystone Cushing Extension Pump Station	Gulf Coast Segment		Houston Lateral
Common Name[1]	**Scientific Name[1]**	**Habitat**	**MT[2,8]**	**SD[3]**	**NE[4]**	**KS[5]**	**OK[6,9]**	**TX**	**TX**
hyacinth	*crassipes*								
Russian olive	*Elaeagnus angustifolia*	Upland, Wetland, Woodland					X		
Quackgrass[7]	*Elymus repens*	Upland				X			
Filaree	*Erodium cicutarium*	Upland					X		X
Leafy spurge	*Euphorbia esula*	Upland	X	X	X	X			
Crimson beauty	*Fallopia japonica*	Upland					X		X
Orange hawkweed	*Hieracium aurantiacum*	Upland	X						
Meadow hawkweed	*Hieracium caespitosum*	Upland	X						
Tall hawkweed	*Hieracium piloselloides*	Upland	X						
N/A	*Hieracium* x. *floribundum*	Upland	X						
Indian rushpea[7]	*Hoffmannseggia densiflora*	Upland				X			
Waterthyme	*Hydrilla verticillata*	Aquatic						X	X
Common St. Johnswort	*Hypericum perforatum*	Upland	X				X		
Swamp morning glory	*Ipomoea aquatica*	Aquatic, Wetland						X	X
Pale yellow iris	*Iris pseudacorus*	Upland, Wetland	X						
Dyer's woad	*Isatis tinctoria*	Upland	X						
Dotted duckmeat	*Landoltia punctata*	Upland					X	X	X
Broadleaved pepperweed	*Lepidium latifolium*	Upland	X						
Chinese lespedeza[7]	*Lespedeza cuneata*	Upland				X			
Oxeye daisy	*Leucanthemum vulgare*	Upland	X						

Table 3.6-3 Noxious and Invasive Weeds Potentially Occurring Along the Proposed Route

			Steele City Segment			Keystone Cushing Extension Pump Station	Gulf Coast Segment		Houston Lateral
Common Name[1]	**Scientific Name**[1]	**Habitat**	**MT**[2,8]	**SD**[3]	**NE**[4]	**KS**[5]	**OK**[6,9]	**TX**	**TX**
Dalmatian toadflax	*Linaria dalmatica*	Upland	X						
Butter-and-eggs	*Linaria vulgaris*	Upland	X						
Chinese honeysuckle	*Lonicera japonica*	Upland, Wetland					X		X
Bacon and Eggs	*Lotus corniculatus*	Upland					X		X
Purple loosestrife	*Lythrum salicaria*	Wetland	X	X	X		X		X
European wand loosestrife	*Lythrum virgatum*	Wetland	X		X				
Pride-of-India	*Melia azedarach*	Upland					X		X
White sweetclover	*Melilotus alba*	Upland					X		
Punktree	*Melakeuca quinquenervia*	Upland						X	X
Eurasian watermilfoil	*Myriophyllum spicatum*	Aquatic	X						
Serrated tussock grass	*Nassella trichotoma*	Upland						X	X
Floating heart	*Nymphoides peltata*	Aquatic					X		
Scotch cottonthistle[7]	*Onopordum acanthium*	Upland					X		
Hemp broomrape	*Orobanche ramosa*	Upland						X	X
Couch panicum	*Panicum repens*	Upland						X	X
Empress tree	*Paulownia tomentosa*	Upland					X		
Common reed	*Phragmites australis*	Upland					X		
Japanese knotweed	*Polygonum cuspidatum*	Upland	X						
Cultivated knotweed	*Polygonum polystachyum*	Upland, Wetland	X						
Giant knotweed	*Polygonum sachalinense*	Upland	X						
White poplar	*Populus alba*	Upland					X		
Curly pondweed	*Potamogeton crispus*	Aquatic					X		

Table 3.6-3 Noxious and Invasive Weeds Potentially Occurring Along the Proposed Route

			Steele City Segment			Keystone Cushing Extension Pump Station	Gulf Coast Segment		Houston Lateral
Common Name[1]	**Scientific Name[1]**	**Habitat**	**MT[2,8]**	**SD[3]**	**NE[4]**	**KS[5]**	**OK[6,9]**	**TX**	**TX**
Sulphur cinquefoil	*Potentilla recta*	Upland	X						
Kudzu[5]	*Pueraria lobata*	Upland				X	X	X	X
Tall buttercup	*Ranunculus acris*	Upland	X						
Mulitflora rose	*Rosa multiflora*	Upland					X		
Itchgrass	*Rottboellia cochinchinensis*	Upland						X	X
Water spangles	*Salvinia minima*	Upland, Wetland						X	X
Russian tumbleweed	*Salsola tragus*	Upland					X		
Kariba-weed	*Salvinia molesta*	Upland						X	X
Stinking willie	*Senecio jacobaea*	Upland	X						
Tropical soda apple	*Solanum viarum*	Upland						X	X
Field sowthistle	*Sonchus arvensis*	Upland, Wetland	X[8]	X					
Johnson grass	*Sorghum halepense*	Upland				X			
Athel tamarisk	*Tamarix aphylla*	Upland, Wetland, Woodland		X					
Five-stamen tamarisk	*Tamarix chinensis*	Upland, Wetland, Woodland		X					
French tamarisk	*Tamarix gallica*	Upland, Wetland, Woodland		X					
Smallflower tamarisk	*Tamarix parviflora*	Upland, Wetland, Woodland		X	X				
Saltcedar	*Tamarix*	Upland,		X	X				

Table 3.6-3 Noxious and Invasive Weeds Potentially Occurring Along the Proposed Route

			Steele City Segment			Keystone Cushing Extension Pump Station	Gulf Coast Segment		Houston Lateral
Common Name[1]	**Scientific Name[1]**	**Habitat**	**MT[2,8]**	**SD[3]**	**NE[4]**	**KS[5]**	**OK[6,9]**	**TX**	**TX**
	ramosissima	Wetland, Woodland							
Tamarisk spp. (salt cedar)	*Tamarix spp.*	Upland, Wetland, Woodland	X				X		
Common tansy	*Tanacetum vulgare*	Upland	X						
Chinese tallow tree	*Triadica sebifera*	Upland, Wetland						X	X
Common mullein	*Verbascum thapsus*	Upland					X		

[1] Updated common and scientific names of noxious and invasive plants were obtained from the PLANTS database as available at: http://plants.usda.gov/ (USDA NRCS 2006).
[2] Noxious weeds as defined by the Montana Department of Agriculture State Noxious Weed List. 2008. http://agr.mt.gov/weedpest/pdf/weedlist3-08.pdf. Website updated on March 27, 2008. Website accessed on April 23, 2008.
[3] Noxious weeds as defined by the South Dakota Department of Agriculture State Noxious Weed List. 2007. http://www.state.sd.us/doa/das/hp-w&p.htm. Website updated on December 5, 2007. Website access on April 23, 2008.
[4] Noxious weeds as defined by the Nebraska Department of Agriculture (NDA) State Noxious Weed List. No date. http://www.agr.state.ne.us/division/bpi/nwp/nwp1.htm. Website accessed on April 23, 2008. These are species which are destructive or harmful and pose a serious threat to the economic, social, or aesthetic well-being of the residents of the state (NDA 2006).
[5] Noxious species declared by Kansas Department of Agriculture legislative action as being 'noxious' (KSDA 2005).
[6] Noxious species declared by Oklahoma Agriculture Food and Forestry (OAFF) legislative action as being 'noxious' (OAFF 2006).
[7] Noxious weeds of concern identified for the Keystone Cushing Extension for Kansas. For more information see the TransCanada Environmental Report (TransCanada 2007) and Department of State Presidential Permit (Dept of State 2008).
[8] Montana Individual Noxious Weed List. 2007. http://agr.mt.gov/weedpest/pdf/county-listed_5-07.pdf. Website accessed on April 24, 2008. Only Fallon County maintained a separate noxious weed list from the state.
[9] Noxious species declared by Oklahoma Agriculture Food and Forestry (OAFF) legislative action as being 'noxious' (OAFF 2006).
[10] Noxious weeds as defined by *USDA/NRCS*

3.7 Wildlife and Fisheries

3.7.1 Terrestrial Wildlife Species

Montana – Steele City Segment

USFWS wetland easement, 3.0 miles of MFWP Conservation easement, 42.6 miles of federally owned land (including 42.2 miles of BLM land and 0.4 miles of Department of Defense land), approximately 1.0 miles of non-

forested wetlands, 200.9 miles of low to moderate quality native grassland, and 3.5 miles of open water (e.g., rivers, lakes, and ponds). Important wildlife habitats that will be crossed by the Project route approximately include the Missouri, Milk, and Yellowstone rivers, as well as the Phillips County USFWS Wetland Easement and the Cornwell Ranch Conservation Easement. Areas of silver sagebrush also provide important habitat for upland game birds such as sage grouse and sharp-tailed grouse.

Phillips County USFWS Wetland Easement

The proposed Project crosses this USFWS wetland easement at between mileposts 4.2 and 5.0 equaling 10.9 acres of disturbance (USFWS – Correspondence with S.Fields_091008) in Phillips County. A wetland easement is described by the USFWS as "a legal agreement signed with the United States of America, through the US Fish and Wildlife Service (Service) that pays you the landowner to permanently protect wetlands. Wetlands covered by an easement cannot be drained, filled, leveled, or burned. When these wetlands dry up naturally, they can be farmed, grazed, or hayed. Wetlands covered by an easement are mapped and a copy of the easement and maps is sent to the landowner. No signs are placed on the property and the easement will not affect hunting or mineral rights." (USFWS Website: http://www.fws.gov/mountain-prairie/realty/wetesmt.htm. Accessed 9/12/08)

Cornwell Ranch Conservation Easement (Montana Fish, Wildlife, and Parks)

The proposed Project crosses 3.0 miles of this MFWP conservation easement distributed along approximate mileposts 49 and 70, equaling 39.7 acres of disturbance. The Cornwell Ranch Conservation Easement was set-up to preserve native wildlife habitats while continuing the land's traditional agricultural use and ownership and guaranteeing public hunting access. The Cornwell Ranch Conservation Easement is primarily funded by MFWP programs supported by hunting licenses. The property provides suitable habitat for game species (including whitetail and mule deer, pronghorn antelope, sage and sharptail grouse, ring-necked pheasants, Merriam's turkeys, several species of ducks, and mourning doves), at-risk species (including long-billed curlew, Sprague's pipit, chestnut-collared longspur, McCown's longspur, Baird's sparrow, ferruginous and Swainson's hawks, and swift fox) (MFWP 2008 – CRCE Proposal and Draft EA)

South Dakota – Steele City Segment

Undeveloped wildlife habitat that will be crossed in South Dakota includes approximately 1.6 miles of non-forested wetlands, 222.6 miles of low to moderate quality native grassland, and 4.2 miles of open water (e.g., rivers, lakes, and ponds). Important wildlife habitats that will be crossed by the Project route include 19.6 miles of SDGFPD property and the Cheyenne and White rivers. Small remnant areas of tall grass prairie and areas of open water (e.g., rivers, lakes, and ponds) also provide important habitat for upland wildlife species and breeding and migrating waterfowl, respectively.

Nebraska – Steele City Segment

Undeveloped wildlife habitat that will be crossed in Nebraska includes approximately 5.8 miles of non-forested wetlands, 123.9 miles of low to high quality native grassland, and 1.7 miles of open water (e.g., rivers, lakes, and ponds). Important wildlife habitats that will be crossed by the Project route include approximately 95 miles within the sandhills region and 50 miles within the Rainwater Basin. These areas of native prairie and areas of open water (e.g., rivers, lakes, and ponds) also provide important habitat for upland wildlife species and breeding and migrating waterfowl, respectively. Important river crossings in Nebraska included the Niobrara, Cedar, Loup, and Platte rivers.

Kansas – Keystone Cushing Extension Pump Stations

Construction of new pump stations along the Keystone Cushing Extension is expected to occur on agricultural lands.

Oklahoma – Gulf Coast Segment

Undeveloped wildlife habitat that will be crossed in the Gulf Coast Segment in Oklahoma (from Cushing to the Oklahoma-Texas border) includes approximately 44.7 miles of forest, 98.3 miles of grassland or rangeland, 11.2 miles of cropland, 0.7 miles of wetlands and 1.2 miles of open water. The only important wildlife habitat identified along this section of the Project route is the Little Fork Wildlife Management area in Creek County. However, small remnant areas of tall grass prairie and areas of open water also provide important habitat for upland wildlife species and breeding and migrating waterfowl, respectively.

Texas – Gulf Coast Segment

Undeveloped wildlife habitat that will be crossed in the Texas Gulf Coast Segment includes approximately 118.9 miles of forest, 96.6 miles of grassland or rangeland, 50.6 miles of cropland, 13.3 miles of wetlands and 1.9 miles of open water. No known important wildlife habitats have been identified along the Project route in Texas. However small remnant areas of tail grass prairie and areas of open water (e.g., rivers, lakes, and ponds) also provide important habitat for upland wildlife species as well as breeding and migratory waterfowl.

Texas –Houston Lateral

Undeveloped wildlife habitat crossed in Texas (HSCL) will include 16.7 miles of forest, no grassland or rangeland, 20.6 miles of cropland, 4.2 miles of wetlands and 0.1 miles of open water. No known important wildlife habitats were identified along the Houston Lateral. However small remnant areas of tail grass prairie and areas of open water also provide important habitat for upland wildlife species and breeding and migrating waterfowl, respectively.

3.7.1.2 Big Game Species

Mule deer, white-tailed deer, and antelope are the principal big game species occurring along the proposed Project (see Table 3.7-1). Certain habitat ranges for these species are considered crucial for maintenance of game populations. The MFWP has identified winter ranges for these game species in Montana. The proposed route crosses approximately 119 miles of winter range for mule deer, 50 miles for white-tailed deer, and 81 miles for antelope. Elk may also be present along the route in Montana but no crucial ranges are crossed by the Project within that state (http://fwp.mt.gov/insidefwp/GIS/download.aspx#Wil).

The majority of the proposed Project crosses private land that will require landowner permission to gain access to property. However, in the Gulf Coast Segment the Little Fork Wildlife Management Area (WMA) in Creek County, Oklahoma is crossed by the proposed route. It provides public hunting opportunities for white-tailed deer as well as other small game species.

3.7.1.3 Small Game Species

Small game species that could occur along the proposed Project and possible alternatives include upland gamebirds, waterfowl, furbearers, and small mammals. Specific species could include mourning dove, northern bobwhite, ring-necked pheasant, greater sage-grouse, greater prairie chicken, sharp-tailed grouse, ruffed grouse, gray partridge, wild turkey, eastern fox squirrel, eastern gray squirrel, red squirrel, eastern cottontail, sandhill crane, and a number of migratory waterfowl. Furbearers include beaver, bobcat, red fox, gray fox, swift fox, raccoon, badger, ermine, least weasel, long-tailed weasel, and mink. The greater sage-grouse is considered the most sensitive small game species along the Projects and is discussed further as a special status species in Appendix F.

3.7.1.4 Nongame Species

The proposed Project traverses various regions which are inhabited by a diversity of nongame species (e.g., small mammals, raptors, songbirds, amphibian, and reptiles) (see Table 3.7-1). Nongame mammals include

shrews, bats, squirrels, prairie dogs, pocket gophers, pocket mice, voles, and mice. These small mammals provide an important prey base for the region's predators including, coyote, badger, skunk, raptors (eagles, buteos, accipiters, owls), and snakes.

Nongame birds include a variety of songbirds and raptor species, most being species associated with open, grassland habitat, although woodland species also are represented along woodland riparian corridors as well as in upland forests along the route. Raptors likely to be present in open habitats include turkey vulture, burrowing owl, golden eagle, red-tailed hawk, Swainson's hawk, northern harrier, ferruginous hawk, American kestrel, short-eared owl, and great horned owl. Woodland associated raptor species likely to be present include the Northern Goshawk, Cooper's hawk, broad-winged hawk, long-eared owl, and eastern screech owl. The northern harrier, short-eared owl, and ferruginous hawk are the only ground nesters.

The majority of the songbirds inhabiting the region, particularly in woodland areas, are neotropical migrants. These are birds that breed in North America but winter in neotropical regions of Central and South America. Examples of neotropical migrants in the area of the proposed route include lark bunting, kingbird, and various vireos and warbler species. Eastern kingbird, American crow, western and eastern meadowlark, horned lark, and sparrows are common open-country inhabitants, while woodpeckers, blue jay, chickadees, wrens, vireos, warblers, and cardinals are typical summer or year-long residents of shrublands and woodlands.

Aerial raptor surveys were conducted for the Steele City Segment between April 7 and 10, 2008, along the ROW in Nebraska, South Dakota, and Montana to identify active and inactive nest sites along the Project ROW (ENSR 2008). The results of the survey are found in Appendix F (Summary Report of the 2008 Aerial Surveys). A total of 105 nests or breeding territories were documented within 1.0 mile of the Project ROW. Of these 105 sites, 49 were determined to be active by raptor species including 27 red-tailed hawk nests, 11 great-horned owl nests, 3 ferruginous hawk nests, 2 golden eagle nests, 2 bald eagle nests, and 1 occupied nests of unknown species. Also, one great blue heron rookery was identified.

Aerial raptor surveys will occur via helicopter along the entire length of the Gulf Coast Segment of the Project construction ROW. The primary survey effort included a visual observation distance of 1.0 miles on either side of the Project centerline. In areas of habitat determined to be suitable for the occurrence of raptors and rookeries/roosts for species such as herons and egrets, an intense secondary effort was accomplished as practicable to identify those areas. These included edge-of-field habitats, open terrain bordering wooded areas, mixed woodlands near open water, large wetland complexes, rivers and impoundments proximal to the ROW. Initial surveys conducted March 24 – 26, 2008 allowed for the most comprehensive window of opportunity for visual field observations. Species presence as well as active and empty nest sites was documented to insure their consideration as potential for occurrence in the surveyed areas and support focus areas for future surveys. Additional surveys are planned in 2009 during a similar period. If construction is to occur during nesting periods (January – August) in 2011/2012, then further survey documentation will occur. The results of the March 2008 aerial surveys can be found in Table 3.7-5.

Table 3.7-1 Game and Furbearer Wildlife Species Potentially Occurring Within the Project Area

Species	Sporting Status	Habitat Association	MT	SD	NE	OK	TX
Mammals							
White-tailed deer *Odocoileus virginianus*	game	This species is found in various habitats from forests to fields with adjacent cover. In northern regions, usually requires stands of conifers for winter shelter. In the north and in montane regions, limited ecologically by the depth/duration/quality of snow cover; summer ranges are traditional but winter range may vary with snow conditions.	X	X	X	X	X
Mule deer *Odocoileus hemionus*	game	This species is found in coniferous forests, desert shrub, chaparral, grasslands with shrubs, and badlands. Often associated with successional vegetation, especially near agricultural lands. Restricted primarily to the western portions of SD, NE, KS, and OK.	X	X	X	X	X
Pronghorn *Antilocapra americana*	game	This species is generally found in grasslands, sagebrush plains, deserts, and foothills. Need for free water varies with succulence of vegetation in the diet. Restricted primarily to the western portions of SD, NE, and KS.	X	X	X		
Elk *Cervus canadensis*	game	This species is generally found in grasslands, sagebrush plains, deserts, and foothills. Need for free water varies with succulence of vegetation in the diet. Restricted primarily to the western portions of SD, NE, and KS.	X		X		
Mountain Lion *Puma concolor*	game	This species is most common in rough, broken foothills and canyon country, often in association with montane forests, shrublands, and pinon-juniper woodlands but periodic reports have included eastern plains.	X		X		
Black bear *Ursus americanus*	game	This species prefers mixed deciduous-coniferous forests with a thick understory, but may occur in various situations. In Project area, MT, MO, OK, and TX.	X			X	X
Eastern gray squirrel *Sciurus carolinensis*	game	This species prefers mature deciduous and mixed forests with abundant supplies of mast (e.g., acorns, hickory nuts). A diversity of nut trees is needed to support high densities. Also uses city parks and floodplains. Seldom far from permanent open water. Nests in tree cavities or in leaf nests, usually 25 feet or more aboveground.				X	X

Table 3.7-1 Game and Furbearer Wildlife Species Potentially Occurring Within the Project Area

Species	Sporting Status	Habitat Association	MT	SD	NE	OK	TX
Eastern fox squirrel *Sciurus niger*	game	Often found in open mixed hardwood forest or mixed pine-hardwood associations, this species has also adapted well to disturbed areas, hedgerows, and city parks. Prefer savannas or open woodlands to dense forests. Western range extensions are associated with riparian corridors of cottonwoods and fencerows of osage orange. Dens are in tree hollows (preferred) or leaf nests (especially in mild weather).		X	X	X	X
Blacl-tailed Jackrabbit *Lepus californicus*	furbearer	Inhabits open plains, fields and deserts; open country with scattered thickets or patches of shrubs.		X		X	X
White-tailed Jackrabbit *Lepus townsendii*	furbearer	Inhabits open plains, fields and deserts; open country with scattered thickets or patches of shrubs.		X			
Eastern cottontail *Sylvilagus floridanus*	game	This species is generally found in early mid-successional habitats over much of continental US. May be found in brushy areas, open woodlands, swampy areas, stream valleys, grasslands, and suburbs. Very adaptable species. Nests usually are in shallow depressions in thick vegetation or in underground burrows.		X	X	X	X
Coyote *Canis latrans*	furbearer	Wide ranging and found in virtually all habitats. Often considered a pest species, especially by the livestock industry. Control programs have been largely ineffective.	X	X	X	X	X
River Otter *Lontra canadensis*	furbearer	Key habitats are rivers, streams, lakes, ponds, marshes, estuaries, and beaver flowages, especially near waterbodies with wooded shorelines or nearby wetlands.	X		X	X	X
Porcupine *Erethizon dorsatum*	game	Prefers coniferous and mixed forests; also inhabits riparian zones, grasslands, shrublands, and deserts in some parts of the range.		X			
Red fox *Vulpes vulpes*	furbearer	Found in various open and semi-open habitats. Usually avoids dense forest, although open woodlands frequently are used. Sometimes occurs in suburban areas or even cities. Maternity dens are in burrows dug by fox or abandoned by other mammals, often in open fields or wooded areas, sometimes under rural buildings, in hollow logs, under stumps, etc.	X	X	X	X	X
Gray fox *Urocyon cinereoargenteus*	furbearer	Found in a variety of habitats including chaparral, rimrock, riparian, old fields, early successional stage woodlands. Usually prefers a diversity of open and wooded areas rather than large tracts of homogeneous habitat.		X	X	X	X

Table 3.7-1 Game and Furbearer Wildlife Species Potentially Occurring Within the Project Area

Species	Sporting Status	Habitat Association	MT	SD	NE	OK	TX
Swift fox *Vulpes velox*	furbearer	The swift fox resides in shortgrass and midgrass prairies over most of the Great Plains. The swift fox will also use agricultural lands and irrigated meadows. Its range includes MT and SD, but is considered a special status species in both states	X	X		X	X
Raccoon *Procyon lotor*	furbearer	Found in a variety of habitats but prefers riparian and edges of wetlands, ponds, and lakes.	X	X	X	X	X
Long-tailed weasel *Mustela frenata*	furbearer	This is the most widespread weasel. It is found in all habitats within the Project area but prefers brushland, open woodlands, and habitats near water.	X	X	X		
Least weasel *Mustela nivalis*	furbearer	Inhabits cultivated fields, brushy areas, open woods, wetland edges, and meadows.	X	X	X	X	X
Mink *Mustela vison*	furbearer	Wetlands; riparian woodlands; edges of lakes, rivers, and ponds.	X	X	X	X	X
Striped skunk *Mephitis mephitis*	furbearer	This species prefers semi-open country with woodland and meadows interspersed, brushy areas, bottomland woods. Frequently found in suburban areas. Dens often under rocks, log, or building. May excavate burrow or use burrow abandoned by other mammal.	X	X	X	X	X
Eastern spotted skunk *Spilogale putorius*	furbearer	Found in forested areas or habitats with significant cover. Also open and brushy areas, rocky canyons and outcrops in woodlands and prairies. When inactive or bearing young, occupies den in burrow abandoned by other mammal, under brushpile, in hollow log or tree, in rock crevice, under building, or in similar protected site.		X	X	X	X
American badger *Taxidea taxus*	furbearer	This species prefers open grasslands and fields and may also frequent brushlands with little groundcover. When inactive, occupies underground burrow.	X	X	X	X	X
Bobcat *Felis rufus*	furbearer	Found in woodlands, brush lands, and wooded swampy areas. Range includes NE, KS, Oklahoma, and Texas, but not Project area portions of South Dakota.	X	X	X	X	X
American beaver *Castor canadensis*	furbearer	Beavers inhabit permanent sources of water of almost any type in their range, which extends from arctic North America to the Gulf of Mexico and arid Southwest, and from sea level to over 6,800 feet in the mountains. They prefer low gradient streams (which they modify), ponds, and small mud-bottomed lakes with dammable outlets. Beavers are associated with deciduous tree and shrub communities.	X	X	X	X	X

Table 3.7-1 Game and Furbearer Wildlife Species Potentially Occurring Within the Project Area

Species	Sporting Status	Habitat Association	MT	SD	NE	OK	TX
Virginia opossum *Didelphis virginiana*	furbearer	The Virginia opossum is North America's only marsupial. The Virginia opossum lives in a wide-variety of habitats including deciduous forests, open woods and farmland. It tends to prefer wet areas like marshes, swamps and streams. The Virginia opossum can be found in most of the United States east of the Rocky Mountains and on the West Coast.		X	X	X	X
Nutria *Myocastor coypus*	furbearer	Throughout much of their natural range in South America, nutria prefers a semi aquatic existence in swamps, marshes, and along the shores of rivers and lakes. Apparently, the nutria is equally at home in salt and fresh water. Nutria are known from aquatic habitats in eastern two-thirds of the state of Texas.					X
Common Muskrat *Ondatra zibethicus*	furbearer	Muskrats are principally marsh inhabitants; creeks, rivers, lakes, drainage ditches, and canals support small populations in places where requisite food and shelter are available. In the interior areas shallow, freshwater marshes with clumps of cattails interspersed among bulrushes, sedges, and other marsh vegetation support the heaviest populations; in coastal areas, the brackish marshes that support good stands of three-square grass (a sedge, *Scirpus*) are most attractive. Such marshes with a stabilized water depth of 15-60 cm seem to offer optimum living conditions.	X	X	X		X
Birds							
Dark Geese: **Canada goose** *Branta canadensis* **White-fronted goose** *Anser albifrons* **Brant** *Branta bernicla*	game	Found in various habitats near water, from temperate regions to tundra. Breed and feed in areas usually near lakes, ponds, large streams, inland and coastal marshes. Forage in pastures, cultivated lands, grasslands, and flooded fields. All but Canada goose present in Project area only during migration.	X	X	X	X	X
Light Geese: **Snow goose** *Chen caerulescens* **Ross' goose** *Chen rossii*	game	Found in various habitats near water, from temperate regions to tundra. Winters in both freshwater and coastal wetlands, wet prairies and extensive sandbars, foraging also in pastures, cultivated lands and flooded fields. Present in Project area only during migration.	X	X	X	X	X
Tundra swan *Cygnus columbianus*	game	Generally found in lakes, sloughs, rivers, sometimes fields, in migration. Open marshy lakes and ponds and sluggish streams in summer. Present in Project area only during migration. Considered a game animal only SD.	X	X		X	X
Trumpeter Swan	game	Their breeding habitat is large shallow ponds and wide slow rivers in	X				

Table 3.7-1 Game and Furbearer Wildlife Species Potentially Occurring Within the Project Area

Species	Sporting Status	Habitat Association	MT	SD	NE	OK	TX
		northwestern and central North America, with the largest numbers of breeding pairs found in Alaska. Natural populations of these swans migrate to and from the Pacific coast and portions of the United States					
Sandhill crane *Grus canadensis*	game	In non-breeding habitats this species roosts at night along river channels, on alluvial islands of braided rivers, or natural basin wetlands. A communal roost site consisting of an open expanse of shallow water is a key feature of wintering habitat. Considered a game species only in SD and OK.		X		X	X
Dabbling ducks: includes a number of species such as mallard and teal	game	Primarily found in shallow waters such as ponds, lakes, marshes, and flooded fields; in migration and in winter mostly in fresh water and cultivated fields, less commonly in brackish situations.	X	X	X	X	X
Diving ducks: includes a number of species such as canvasback and redhead	game	Commonly found on marshes, ponds, lakes, rivers and bays.	X	X	X	X	X
Mergansers and Coot	game	Commonly found on marshes, ponds, lakes, rivers and bays.	X	X	X	X	X
Woodcock *Scolopax mir* **Snipe** *Gallinago gallinago*	game	Wetlands, marshes, moist woodlands and thickets.	X	X	X	X	X
Mourning dove *Zenaida macrora*	game	Inhabits open woodland, forest edge, cultivated lands with scattered trees and bushes, arid, and desert country.	X	X	X	X	X
American Crow *Corvus Brachyrhynchos*	game	Inhabits a variety of habitats, including open country, agricultural lands, open forests and woodlands, riparian woodlands and suburban areas.		X	X	X	X
Ring-necked pheasant *Phasianus colchicus*	game	Non-native game bird. Inhabits open country (especially cultivated areas, scrubby wastes, open woodland and edges of woods), grassy steppe, desert oases, riverside thickets, swamps and open mountain forest. Winter shelter includes bushes and trees along streams, shelterbelts, and fencerows. Usually nests in fields, brushy edges, or pastures, also along road ROWs. Nest is shallow depression scratched out by female.	X	X	X	X	X
Wild turkey *Meleagris gallopavo*	game	Found in forest and open woodland, scrub oak, deciduous or mixed deciduous-coniferous areas. Also agricultural areas in some regions, which may provide important food resources in winter. Roosts in trees at night. Nests normally on the ground, usually in open areas at the edge of woods.	X	X	X	X	X

Table 3.7-1 Game and Furbearer Wildlife Species Potentially Occurring Within the Project Area

Species	Sporting Status	Habitat Association	MT	SD	NE	OK	TX
Greater prairie chicken *Tympanus cupido*	game	Inhabits tall grassland prairies and occasionally croplands. Nests in grasslands, prairies, pastures, and hayfields. Within the Project area present only in KS and OK.		X	X	X	X
Sage Grouse *Centrocercus urophasianus*	game	Inhabit sagebrush communities.	X	X			
Sharp-tailed grouse *Tympanuchus phasianellus*	game	Inhabits short to tall grasslands intermixed with cropland and shrublands.	X	X	X		
Northern bobwhite *Colinus virginianus*	game	Inhabits a wide variety of vegetation types, particularly early successional stages. Occurs in croplands, grasslands, pastures, fallow fields, grass-brush rangelands, open pinelands, open mixed pine-hardwood forests, and habitat mosaics. In the Midwest and Northeast, associated principally with heterogeneous, patchy landscapes comprised of moderate amounts of row crops and grasslands and abundant woody edge. Nests on the ground, in a scrape lined with grasses and/or other dead vegetation.	X	X	X	X	X
Gray partridge (Hun) *Perdix perdix*	game	Non-native game bird. Inhabits cultivated land, hedgerows, brushy pastures, and meadows.	X	X	X	X	X
Ruffed grouse *Bonasa umbellus*	game	Inhabits mixed and deciduous woodlands. Not common in Project area but occurs in isolated areas of SD.	X	X		X	

3.7.2 Aquatic Resources

Aquatic biology resources are defined in this study as fish and invertebrate communities that inhabit perennial streams and pond/lake environments. The description of aquatic communities focuses on important fisheries, which are defined as species with recreational or commercial value or threatened, endangered, or sensitive status (i.e., special status). This section describes recreationally or commercially important fisheries that occur at or immediately downstream of the proposed crossings. Special status aquatic species are discussed in Section 3.7.3. The study area for aquatic resources includes the perennial streams, rivers, and ponds/lakes that will be crossed by the proposed Project. Other waterbodies are included if they are located within approximately 0.5 mile of the proposed crossing and support recreationally or commercially important game fish or special status aquatic species.

Invertebrate communities in waterbodies along the proposed Project include worms, immature and adult insect groups, shellfish, and other forms of aquatic life. The composition can vary depending on flowing or standing water and other physical characteristics of the waterbody. They represent important food sources for fish and also are used as indicators of water quality conditions. For the purpose of describing aquatic resources, it is assumed that invertebrates are present in all Project area waterbodies.

Steele City Segment

For the Steele City Segment, over 19 recreationally important fish species or groups occur in waterbodies crossed by the proposed route (Table 3.7-4). These include shovelnose sturgeon, paddlefish, bass, sunfish, walleye, Northern pike, catfish, and perch. The following information describes game and commercial fish species occurrence, fishery classifications, and characteristics of fishery management in each of the states traversed by the Project. Fishery classification definitions are provided in Table 3.7-3. General spawning periods for the primary game and commercial fish species are identified in Table 3.7-4.

Steele City Segment - Montana

The Project will cross 20 perennial streams in Montana and numerouse intermittent streams. Two of these streams (Missouri and Yellowstone Rivers) are considered Class I and II fisheries by MFWP that support Blue and Red Ribbon Fisheries. These include 4 larger rivers; the Milk River, the Missouri River, the Redwater River and the Yellowstone River. The remaining streams are smaller in width. The Missouri River east of Fort Peck Reservoir to the border of Richland County is classified as a Red Ribbon Fishery and the Yellowstone River through Prairie County is classified as a Blue Ribbon Fishery. Game fish include a variety of warm water species such as burbot, walleye, crappie, channel catfish, pumpkinseed, sauger, green sunfish, bluegill, northern pike, sturgeon and paddlefish (BLM 1995). The remaining streams are considered non-salmonid fisheries.

Steele City Segment - South Dakota

The Project will cross 11 streams in South Dakota containing game and/or commercial fisheries. These include one permanent warmwater fishery (Cheyenne River) and three semipermanent warmwater fisheries (White, South Fork Grand, and Little Missouri Rivers). The remaining streams are identified as marginal warmwater streams. Common game fish found in these streams include catfish, walleye, sauger, bullhead, and bass (SDGFP 1997).

Steele City Segment - Nebraska

The Project will cross 12 Class A warmwater fisheries, seven Class B warmwater fisheries, and two Class B coldwater fisheries in Nebraska. Common game fish include catfish, sturgeon, and carp. In addition, forage fish species important to special status species (e.g. interior least tern) are found in the Platte, Niobrara, and Loup Rivers.

Keystone Cushing Extension Pump Stations - Kansas

Construction of new pump stations in Kansas associated with the Project will not intersect with perennial streams.

Table 3.7-2 Game Fisheries in Waterbodies Crossed or Downstream of the Proposed Project

Waterbody	County	Fishery Class[1]	Number of Crossings
Steele City Segment - Montana			
Dunham Coulee	Phillips	Non-Salmonid Fishery	1
Corral Coulee	Phillips	Non-Salmonid Fishery	2
Frenchman Creek	Valley	Non-Salmonid Fishery	1
Hay Coulee	Valley	Non-Salmonid Fishery	1
Rock Creek	Valley	Non-Salmonid Fishery	1
Willow Creek	Valley	Non-Salmonid Fishery	1
Lime Creek	Valley	Non-Salmonid Fishery	1
Black Coulee	Valley	Non-Salmonid Fishery	1
Brush Fork	Valley	Non-Salmonid Fishery	1
Bear Creek	Valley	Non-Salmonid Fishery	1
Unger Coulee	Valley	Non-Salmonid Fishery	1
Buggy Creek	Valley	Non-Salmonid Fishery	1
Alkali Coulee	Valley	Non-Salmonid Fishery	1
Wire Grass Coulee	Valley	Non-Salmonid Fishery	1
Spring Creek	Valley	Non-Salmonid Fishery	1
Mooney Coulee	Valley	Non-Salmonid Fishery	1
Cherry Creek	Valley	Non-Salmonid Fishery	1
Foss Coulee	Valley	Non-Salmonid Fishery	1
Spring Coulee	Valley	Non-Salmonid Fishery	1
East Fork Cherry Creek	Valley	Non-Salmonid Fishery	1
Milk River	Valley	Salmonid, Red Ribbon Fishery	1
Missouri River	McCone	Non-Salmonid Fishery Red Ribbon, Class II	1
West Fork Lost Creek	McCone	Non-Salmonid Fishery	1
Jorgensen Coulee	McCone	Non-Salmonid Fishery	1
Cheer Creek	McCone	Non-Salmonid Fishery	1
Bear Creek	McCone	Non-Salmonid Fishery	1

Table 3.7-2 Game Fisheries in Waterbodies Crossed or Downstream of the Proposed Project

Waterbody	County	Fishery Class[1]	Number of Crossings
South Fork Shade Creek	McCone	Non-Salmonid Fishery	1
Flying V Creek	McCone	Non-Salmonid Fishery	2
Figure Eight Creek	McCone	Non-Salmonid Fishery	1
Middle Fork Prairie Elk Creek	McCone	Non-Salmonid Fishery	1
East Fork Prairie Elk Creek	McCone	Non-Salmonid Fishery	1
Lone Tree Creek	McCone	Non-Salmonid Fishery	1
Redwater River	McCone	Non-Salmonid Fishery	1
Buffalo Springs Creek	McCone	Non-Salmonid Fishery	3
Cottonwood Creek	Dawson	Non-Salmonid Fishery	1
Berry Creek	Dawson	Non-Salmonid Fishery	1
Hay Creek	Dawson	Non-Salmonid Fishery	1
Upper Seven Mile Creek	Dawson	Non-Salmonid Fishery	1
Clear Creek	Dawson	Non-Salmonid Fishery	1
Cracker Box Creek	Dawson	Non-Salmonid Fishery	1
Yellowstone River	Dawson	Non-Salmonid Fishery, Blue Ribbon, Class I	1
Cabin Creek	Prairie	Non-Salmonid Fishery	1
West Fork Hay Creek	Prairie	Non-Salmonid Fishery	1
Hay Creek	Prairie	Non-Salmonid Fishery	2
Dry Fork Creek	Fallon	Non-Salmonid Fishery	2
Pennel Creek	Fallon	Non-Salmonid Fishery	1
Sandstone Creek	Fallon	Non-Salmonid Fishery	1
Red Butte Creek	Fallon	Non-Salmonid Fishery	1
Hidden Water Creek	Fallon	Non-Salmonid Fishery	1
Little Beaver Creek	Fallon	Non-Salmonid Fishery	1
Soda Creek	Fallon	Non-Salmonid Fishery	1
North Fork Coal Bank Creek	Fallon	Non-Salmonid Fishery	1
South Fork Coal Bank Creek	Fallon	Non-Salmonid Fishery	1
Boxelder Creek	Fallon	Non-Salmonid Fishery	1
Steele City Segment - South Dakota			
Little Missouri River	Harding	WW Semipermanent	1
South Fork Grand River	Harding	WW Semipermanent	1

Table 3.7-2 Game Fisheries in Waterbodies Crossed or Downstream of the Proposed Project

Waterbody	County	Fishery Class[1]	Number of Crossings
Clark's Fork Creek	Harding	WW Marginal	1
North Fork Moreau River	Butte	WW Marginal	1
South Fork Moreau River	Perkins	WW Marginal	1
Sulfur Creek	Meade	WW Marginal	1
Red Owl Creek	Meade	WW Marginal	1
Cheyenne River	Pennington	WW Permanent	1
Bad River	Haakon	WW Marginal	1
Williams Creek	Jones	WW Marginal	1
White River	Tripp	WW Semipermanent	1
Steele City Segment – Nebraska			
Keya Paha River	Keya Paha	Class A Warmwater	1
Spring Creek	Keya Paha	Class B Coldwater	1
Niobrara River	Rock	Class A Warmwater	1
Ash Creek	Rock	Class B Coldwater	1
North Branch Elkhorn River	Holt	Class A Warmwater	1
South Fork Elkhorn River	Holt	Class A Warmwater	1
Holt Creek	Holt	Class A Warmwater	1
Dry Creek	Holt	Class A Warmwater	2
South Fork Elkhorn River	Holt	Class A Warmwater	1
Cedar River	Wheeler	Class A Warmwater	1
South Branch Timber Creek	Nance	Class B Warmwater	1
Loup River	Nance	Class A Warmwater	1
Prairie Creek	Merrick	Class B Warmwater	1
Platte River	Merrick	Class A Warmwater	1
Big Blue River	York	Class B Warmwater	2
Lincoln Creek	York	Class B Warmwater	1
Beaver Creek	York	Class B Warmwater	1
West Fork Big Blue River	York	Class A Warmwater	1
Turkey Creek	Filmore	Class B Warmwater	1
South Fork Swan Creek	Saline	Class B Warmwater	1
Cub Creek	Jefferson	Class A Warmwater	1
Keystone Cushing Extension Pump Stations - Kansas			

Table 3.7-2 Game Fisheries in Waterbodies Crossed or Downstream of the Proposed Project

Waterbody	County	Fishery Class[1]	Number of Crossings
N/A			
Gulf Coast Segment - Oklahoma			
Red River	Bryan	WWAC	1
Muddy Boggy Creek	Atoka	WWAC	2
Clear Boggy Creek	Atoka	WWAC	8
Fronterhouse Creek	Atoka	WWAC	1
Cow Pen Creek	Atoka	WWAC	1
Caney Creek	Atoka	WWAC	1
White Grass Creek	Bryan	WWAC	1
Bois D' Arc Creek	Bryan	WWAC	1
Straight Creek	Bryan	WWAC	1
Clear Boggy Creek	Coal	WWAC	1
Owl Creek	Coal	WWAC	1
Muddy Boggy Creek	Coal	WWAC	1
Canadian River	Hughes	WWAC	1
Little River	Hughes	WWAC	1
Bird Creek	Hughes	WWAC	1
Sand Creek	Seminole	WWAC	1
Wewoka Creek	Seminole	WWAC	1
Little Wewoka Creek	Seminole	WWAC	1
North Canadian River	Okfuskee	WWAC	1
Pettiquah Creek	Okfuskee	WWAC	1
Deep Fork River	Creek	WWAC	1
Rattlesnake Creek	Lincoln	WWAC	2
Gulf Coast Segment - Texas			
Red River	Fannin	High	1
Sanders Creek	Lamar	High	1
Cottonwood Creek	Lamar	High	1
Justiss Creek	Lamar	High	1
North Sulphur River	Delta	High	1
South Sulphur River	Delta	High	1
White Oak Creek	Hopkins	High	1

Table 3.7-2 Game Fisheries in Waterbodies Crossed or Downstream of the Proposed Project

Waterbody	County	Fishery Class[1]	Number of Crossings
Cross Timber Creek	Hopkins	High	1
Brushy Creek	Franklin	High	1
Cypress Creek	Franklin	High	3
Sand Creek	Wood	High	2
Clear Creek	Wood	High	1
Nicols Branch	Wood	High	1
Big Sandy Creek	Upshur	High	1
Sabine River	Upshur	High	1
Johnson Creek	Rusk	High	1
Angelina River	Rusk	High	1
East Fork Angelina River	Rusk	High	1
Indian Creek	Nacogdoches	High	2
Angelina River	Nacogdoches	High	1
Bodan Creek	Nacogdoches	High	1
Crawford Creek	Nacogdoches	High	1
Hurricane Creek	Nacogdoches	High	1
Neches River	Angelina	High	1
Piney Creek	Polk	High	1
Big Sandy Creek	Polk	High	1
Bundix Creek	Polk	High	2
Menard Creek	Polk	High	2
Arizona Creek	Liberty	High	1
Pine Island Bayou	Hardin	High	1
Mayhew Creek	Hardin	High	1
Cotton Creek	Jefferson	High	1
Neches Valley Canal Authority	Jefferson	High	1
BI Canal	Jefferson	High	1
Houston Lateral - Texas			
Trinity River	Liberty	High	1
Old River	Liberty	High	1
Cedar Bayou	Harris	High	1
San Jacinto River	Harris	High	1

Table 3.7-2 Game Fisheries in Waterbodies Crossed or Downstream of the Proposed Project

Waterbody	County	Fishery Class[1]	Number of Crossings

[1] Fishery classifications, as part of surface water classifications, are defined in Table 3.7-3.

Sources for fish occurrence: Berry et al. (2004); MRIS 1999;MTDEQ 2006b; NDEQ 2006; SDDENR 2008a; Oklahoma Water Resources Board (2008); Texas Department of Environmental Quality (2003).

Table 3.7-3 Surface Water Classification

State	Classification	Definition
Montana	Non-Salmonid	Waters that do not provide habitat for trout and salmon species. Non-salmonid species include sturgeons, suckers, minnows, etc.
	Blue Ribbon – Class I	Recreational fishery of outstanding value.
	Red Ribbon – Class II	Recreational fishery of high value.
South Dakota	WW Permanent	Warmwater permanent fish life propagation waters.
	WW Semipermanent	Warmwater semipermanent fish life propagation waters.
	WW Marginal	Warmwater marginal fish life propagation waters.
Nebraska	Class A - Warmwater	Waters provide, or could provide, a habitat suitable for maintaining one or more identified key species on a year-round basis. Waters also are capable of maintaining year-round populations of a variety of other warmwater fish and associated vertebrate and invertebrate organisms and plants.
	Class B - Warmwater	Waters where the variety of warmwater biota is presently limited by water volume or flow, water quality (natural or irretrievable human-induced conditions), substrate composition, or other habitat conditions. These waters are only capable of maintaining year-round populations of tolerant warmwater fish and associated vertebrate and invertebrate organisms and plants. Key species may be supported on a seasonal or intermittent basis (e.g., during high flows) but year-round populations cannot be maintained.
	Class B – Coldwater	These are waters which provide, or could provide, a habitat capable of maintaining year-round populations of a variety of coldwater fish and associated vertebrate and invertebrate organisms and plants or which support the seasonal migration of salmonids. These waters do not support natural reproduction of salmonid populations due to limitations of flow, substrate composition, or other habitat conditions, but salmonid population may be maintained year-round if periodically stocked.
Kansas	Special Aquatic Life Use (S)	Surface waters that contain unique habitats or biota that are not commonly found in the state. Surface waters that contain populations of threatened or endangered species will be designated as special aquatic life use waters. Kansas Department of Wildlife and Parks and the USFWS have been consulted in order to determine the presence of threatened and endangered species.

Table 3.7-3 Surface Water Classification

State	Classification	Definition
	Expected Aquatic Life Use (E)	Surface waters that contain habitats or biota found commonly in the state.
	Restricted Aquatic Life Use (R)	Surface waters that contain biota in a limited abundance or diversity due to the physical quality or availability of habitat compared to more productive habitats in adjacent waters.
Oklahoma	Warm Water Aquatic Community (WWAC)	Fish and Wildlife Propagation Category for climax warm water communities
	Habitat Limited Aquatic Community (HLAC)	Ephemeral, intermittent or low flow conditions prevent the WWAC attainment use
	Cool Water Aquatic Community (CWAC)	Supports a cool water climax fish community and benthos that may include smallmouth bass, certain darters and stoneflies
	Trout Fishery (TF)	Supports a seasonal “Put and Take” trout fishery
Texas	Exceptional Aquatic Life Use (E)	Exceptional-Habitat with outstanding natural variability; exceptional or unusual species assemblages with abundant sensitive species present, exceptionally high diversity, exceptionally high species richness and a balanced trophic structure.
	High Aquatic Life Use (H)	High-Habitat highly diverse with usual association of regionally expected species; sensitive species present with high diversity, high species richness and a balanced to slightly imbalanced trophic structure
	Intermediate Aquatic Life Use (I)	Intermediate-Habitat moderately diverse with some expected species present; sensitive species very low in abundance with moderate diversity, moderate species richness and a moderately imbalanced trophic structure
	Limited Aquatic Life Use (L)	Limited-Habitat uniform with most regionally expected species absent, sensitive species absent, low diversity, low species richness and a severely imbalanced trophic structure

Gulf Coast Segment

For the Gulf Coast Segment and the Houston Lateral, 31 recreationally and commercially important fish species or groups have been noted as potentially occurring in waterbodies crossed by the proposed route (Table 3.7-2). These include gars, shads, minnows, suckers, temperate basses, black basses, sunfishes, catfishes, and drum in freshwater dominated systems and include Menhaden, Spotted Seatrout, Red Drum, and Croaker in estuarine systems. All 31 species have the potential to occur in Texas, with the 27 freshwater species potentially occurring in Oklahoma. Typical streams within this South Central Plain Ecogregion support diverse communities of indigenous or adapted fish species. These fish communities are characterized by a limited number of sensitive species distinctly dominated by sunfishes followed by darters and minnows. The following information describes game and commercial fish species occurrence, fishery classifications (designated use categories), and characteristics of fishery management in each of the states traversed by the proposed route.

Sources of fish classification are identified at the end of Table 3.7-2. Fishery classification definitions are provided in Table 3.7-3. General spawning periods for the primary game and commercial fish species are identified in Table 3.7-4.

Table 3.7-4. Game and Commercial Fish Spawning Periods and Habitat

Species or Group [1]	Months [2]												Habitat
	J	F	M	A	M	J	J	A	S	O	N	D	
Steele City Segment and Keystone Cushing Extension[3]													
Burbot													Eggs are scattered over sand or gravel substrates.
Basses													Shallow areas over clean gravel and sand bottoms.
Brown bullhead													Spawn in shallow areas by building nests in mud substrate.
Bullheads (yellow and black)													Usually spawn in weedy or muddy shallow areas by building nests.
Buffalos													Spawn at depths of four to 10 feet over gravel or sand substrates.
Carp													Adhesive eggs scattered in shallow water over vegetation, debris, logs, or rocks.
Catfishes (flathead and blue)													Nest builders with habitat similar to channel catfish.
Channel catfish													Prefers areas with structure such as rock ledges, undercut banks, logs, or other structure where it builds nests.
Crappies													Eggs deposited in depressions on bottom in cove or embayments.
Freshwater drum													Buoyant eggs drift in river currents during development.
Muskellunge													Spawn in tributary streams and shallow lake channels.
Northern pike													Small streams or margins of lakes over submerged vegetation.
Paddlefish													Moves into rivers and spawns over flooded gravel bars.
Sauger													Moves into tributary streams or backwaters where they spawn over rock substrates.
Shovelnose sturgeon													Spawning occurs in open water channels of large rivers over rocky or gravelly bottoms.
Sunfishes													Nest builders in diverse substrates and shallow depths.
Walleye													Spawn in lakes and streams in shallow water over rock substrates.
White bass													Egg masses deposited over sand bars, submerged

Table 3.7-4. Game and Commercial Fish Spawning Periods and Habitat

Species or Group [1]	Months [2] J	F	M	A	M	J	J	A	S	O	N	D	Habitat
													vegetation, or other instream debris.
Yellow perch													Shallow open water over weedy areas.
Gulf Coast Segment and Houston Lateral													
Atlantic Croaker													Spawning is near shore.
Black Basses (Spotted, Largemouth)													Males construct a nest in whatever substrate is available but gravel is preferred in depths of 1-15 ft.
Catfishes (Black bullhead, Yellow bullhead, Blue, Channel, Flathead)													Spawning occurs in a dark natural cavity or hole cleaned by the male in an undercut bank, underneath a submerged log or pile of debris.
Crappies (White, Black)													Nests may be located in depths of 1-20 ft. usually in silt-free substrates near a log, stump or aquatic vegetation.
Freshwater Drum													Spawns in deep water of open pools.
Gars (Alligator, Spotted, Longnose, Shortnose)													Large numbers of individuals congregate in shallow, sluggish pools and backwaters. Adhesive eggs scattered over the substrate and then abandoned.
Gulf Menhaden													Spawning occurs offshore.
Minnows (Golden Shiner, Fathead) note: these species are important commercially as baitfish for crappie and bass fishing													Fathead males prepare and defend a nest over available substrate. Eggs and sperm are released with eggs deposited on the ceiling of the nest site. Golden shiners do not construct a nest or offer parental care. Spawning occurs over available submerged vegetation and debris where they adhere.
Red Drum													Spawning occurs near shore and inshore waters close to barrier island passes and channels.
Shads (Gizzard, Threadfin) note: these fishes are important to game species as forage													Spawning usually occurs at night during a rise in water temperature with the fish swimming near the surface in shallow backwaters or near shore. Eggs sink to be bottom and attach to any available substrate with no parental care.
Spotted Seatrout													Estuarine dependent and completes its entire life cycle in inshore waters typically within coastal bays, estuaries, and lagoons, usually in shallow grassy areas, or near passes and in deeper holes or channels with eggs drifting into the grassy areas.

Table 3.7-4. Game and Commercial Fish Spawning Periods and Habitat

	Months [2]												
Species or Group [1]	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**Habitat**
Suckers (Smallmouth Buffalo)													Spawning occurs in quiet shallow backwaters or on flooded lands during high-water periods. Adhesive eggs are deposited over the bottom or on vegetation.
Sunfishes (Redbreasted, Green, Warmouth, Bluegill, Longear, Redear)													Males build nests with circular depressions in diverse substrates and shallow depths and guard the nest after spawning.
Temperate Basses (White, Striped)													Females enter the area where males have formed schools over spawning ground with spawning take place near the surface usually in some current. Adhesive fertilized eggs settle to the bottom and become attached to the gravel substrate. In Striped bass, the eggs are semibouyant and are carried by current until hatch.

[1] Rainbow trout is not included because the species does not spawn in streams crossed by the pipeline route.

[2] Spawning periods are approximate and could occur in only a portion of a particular month.

Sources: Eddy and Underhill (1974); Harlan et al. (1987); Pflieger (1975); Pflieger (1997); Hoese and Moore (1977); Douglas (1974); Robison and Buchanan (1988); Thomas et. al. (2007); Miller and Robison (2004); Ross (2001), and Pattillo et. al. (1997); [3] Keystone Cushing Extension do not cross perennial streams

Gulf Coast Segment - Oklahoma

The Oklahoma portion of the Gulf Coast Segment will cross 4 listed rivers, 56 perennial streams and 91 unnamed intermittent streams. Oklahoma assesses the condition of the state's surface waters and through USEPA-approved designated uses, manages and protects these waters with defined water quality standards. Designated use categories establish the conditions necessary to provide a level of water quality necessary for the support of fish and wildlife propagation. Four classifications are used to sustain and manage these fisheries: "Habitat Limited Aquatic Community", "Warm Water Aquatic Community", "Cool Water Aquatic Community", and "Trout Fishery" (Table 3.7-3). In Oklahoma, all waters crossed by the pipeline corridor have been determined to be either 1) adequate to support climax fish communities and therefore are categorized as a Warm Water Aquatic Community or 2) Habitat Limited Aquatic Community, because intermittent and ephemeral streams in Oklahoma are not adequate to support a Warm Water Fish Community.

The designated Warm Water Aquatic Community in these systems supports a diverse fishery that includes the Arkansas River Shiner, the Paddlefish and the Shovelnose Sturgeon (Appendix F). While limited in distribution in the waters of concern, no negative impacts are likely to exist due to the crossing of these waterbodies by HDD methodology. Twenty-seven recreationally and commercially important climax species have a range of distribution that supports their potential to occur within the proposed pipeline crossing corridor based upon surface water classification by the state of Oklahoma (Tables 3.7-2 and 3.7.3), their geographic range and habitat as noted by Douglas (1974); Miller and Robison (2004); Pflieger (1997); Robison and Buchanan (1988); Ross (2001); and Thomas et. al. (2007).

Gulf Coast Segment - Texas

The Texas portion of the Project will cross 6 listed rivers, 93 perennial streams, and 90 unnamed intermittent streams. Texas assesses the condition of the state's surface waters and has established designated uses as

promulgated by the US EPA and included them in their defined water quality standards. The categories establish the conditions necessary to provide a level of water quality necessary for the support, protection and propagation of aquatic life. Exceptional, high, intermediate and limited categories have been described to set the benchmark for measure (Table 3.7-3). In Texas, unless otherwise listed, perennial streams, rivers, lakes, estuaries, and other appropriate perennial waters are presumed to have a "high" aquatic life use in accordance with ecoregion studies, dissolved oxygen criteria, and trophic structure. Intermittent streams are not considered to have a continuous significant aquatic life use except as dictated seasonally. "High" habitat imparts a highly diverse and usual association of regionally expected species. This includes the presence of sensitive species with high diversity, high species richness and a balanced to slightly imbalanced trophic structure. Unclassified intermittent streams with significant aquatic life uses created by perennial pools are presumed to have a "Limited" aquatic life use. Vegetation and physical components of the aquatic environment will be maintained or mitigated to protect aquatic life uses.

The designated "high" aquatic life use in these systems of waterbodies supports a diverse fishery that includes the Arkansas River shiner, the paddlefish and the shovelnose sturgeon (Appendix F). While limited in distribution in the waters of concern, no negative impacts are likely to exist due to the crossing of these waterbodies by HDD methodology. Thirty-one recreationally and commercially important species have a range of distribution that supports their potential to occur within the proposed pipeline crossing corridor based upon surface water classification by the state of Texas (Tables 3.7-2 and 3.7.3), their geographic range and habitat as noted by Douglas (1974); Hoese and Moore (1977); Miller and Robison (2004); Pattillo et. al. (1997); Pflieger (1997); Robison and Buchanan (1988); Ross (2001) and Thomas et. al. (2007).

Houston Lateral - Texas

The Houston Lateral will cross 3 listed rivers, 2 perennial streams and 5 unnamed intermittent streams. Texas assesses the condition of the state's surface waters and has established designated uses as promulgated by the US EPA and included them in their defined water quality standards. The categories establish the conditions necessary to provide a level of water quality necessary for the support, protection, and propagation of aquatic life. Exceptional, high, intermediate and limited categories have been described to set the benchmark for measure (Table 3.7-3). In Texas, unless otherwise listed, perennial streams, rivers, lakes, estuaries, and other appropriate perennial waters are presumed to have a "high" aquatic life use in accordance with ecoregion studies, dissolved oxygen criteria, and trophic structure. Intermittent streams are not considered to have a continuous significant aquatic life use except as dictated seasonally. "High" habitat imparts a highly diverse and usual association of regionally expected species. This includes the presence of sensitive species with high diversity, high species richness, and a balanced to slightly imbalanced trophic structure. Unclassified intermittent streams with significant aquatic life uses created by perennial pools are presumed to have a "Limited" aquatic life use. Vegetation and physical components of the aquatic environment will be maintained or mitigated to protect aquatic life uses.

The designated "high" aquatic life use in these systems of waterbodies supports a diverse fishery that includes the Arkansas River Shiner, the Paddlefish and the Shovelnose Sturgeon (Appendix F). While limited in distribution in the waters of concern, no negative impacts are likely to exist due to the crossing of these waterbodies by HDD methodology. Thirty-one recreationally and commercially important species have a range of distribution that supports their potential to occur within the proposed pipeline crossing corridor based upon surface water classification by the state of Texas (Tables 3.7-2 and 3.7.3), their geographic range, and habitat as noted by Douglas (1974); Hoese and Moore (1977); Miller and Robison (2004); Pattillo et. al. (1997); Pflieger (1997); Robison and Buchanan (1988); Ross (2001) and Thomas et. al. (2007).

3.7.3 Sensitive Terrestrial and Aquatic Wildlife Species

Using the initial route, existing agency data bases, land use/land cover data, literature, and agency website information, a list of potential threatened, endangered, and/or species of concern (sensitive species), designated by state or federal agencies, was created for the Project area. Keystone then reviewed aerial photography, USGS maps, and previous field studies from the Project area and eliminated species not likely to occur based

upon habitat traversed or a species historical range (see Table 3.7-6). This list was then used as a basis for discussion with the regulators to further refine and eliminate species not likely to occur and/or would not likely be impacted. This resulted in the development of survey protocols (see Appendix F) for each state with the final list of species that could potentially occur in the project area. Surveys in 2008 were then undertaken to survey for species presence/absence (if in the suitable survey window) and/or to survey for potential habitat to refine the locations where presence/absence surveys would occur in early 2009. Appendix F contains all contact reports, meeting minutes, and correspondence to/from agencies concerning this effort. Appendix F also contains copies of the survey protocols and the master list of species requiring survey.

Coordination with state wildlife agencies and the USFWS was initiated in March 2008, in a series of overview and information request meetings conducted state by state. Follow-up meetings were then arranged by state to discuss wildlife impacts specifically. Agencies were given survey protocol packages ahead of the meetings to review prior to approval.

3.7.3.2 Terrestrial Species

Based upon data obtained from agency websites and agency consultations, a total of 95 terrestrial wildlife species were identified as potentially occurring within the Steele City Segment. These species, their associated habitats, and their potential for occurrence along the proposed route are listed and summarized in Appendix F. Occurrence potential along the proposed route was evaluated for each species based on its habitat requirements and/or known distribution. Based on these evaluations, one terrestrial species was eliminated from detailed analysis. Of the remaining 94 terrestrial species that are analyzed in detail, 73 are special status species and 21 are species of concern.

Based upon data obtained from agency websites (ONHI 2003, TPWD 2008, USFWS 2008, USFWS 2007) and meetings with agency personnel (ODWC 2008, TPWD 2008a, USFWS 2008b, USFWS 2008c, USFWS 2008d, UFWS 2008e), a total of 39 terrestrial wildlife species (32 special status species and 7 species of special concern) were identified as potentially occurring within the Project area of the Gulf Coast Segment and the Houston Lateral. Additionally, rookeries were identified as a significant conservation concern and will require protection from disturbances due to construction. These species, their associated habitats, and their potential for occurrence along the proposed route are listed and summarized in Appendix F. Occurrence potential along the proposed route was evaluated for each species based on its habitat requirements and/or known distribution. Based on these evaluations, one special status terrestrial species, the red wolf, was eliminated from detailed analysis based on this species extirpation from its former distribution in Oklahoma and Texas. Of the remaining 38 terrestrial species that are analyzed in detail, 31 are special status species and 7 are species of special concern. A summary of sensitive species that occur along the proposed route are provided below by state.

Steele City Segment - Montana

A total of 67 special status wildlife species could potentially occur within suitable habitat along the proposed route in Montana. Of the 67, five (black-footed ferret, whooping crane, interior least tern, piping plover, and the pallid sturgeon) are federally listed, 49 are identified as BLM species of concern, and 21 are Montana species of concern.

Based on correspondence and consultation with the USFWS, BLM, and MFWP (May 8 and July 29, 2008 Meeting Notes: BLM 2008 – F. Prellwitz: BLM 2008 K. Undlin) respectively, species specific surveys will be required for 32 species (see Appendix F). Surveys in 2008 were conducted for bald eagles and raptors and is presented in Appendix F.

Steele City Segment - South Dakota

A total of 14 special status wildlife species (river otter, swift fox, black-footed ferret, bald eagle, whooping crane, piping plover, interior least tern, peregrine falcon, longnose sucker, sturgeon chub, blacknose shiner, northern

redbelly dace, pearl dace, and American burying beetle) could potentially occur within suitable habitat along the proposed route in South Dakota.

Based on correspondence and consultation on June 10, 2008 with the SDGFD and the USFWS species specific surveys will be required for 10 species (see Appendix F).

Surveys for the American burying beetle were initiated in August 2008 with the completion of a habitat assessment (Appendix F – ABB Survey Report). Known historic occurrence data exists along the Project route in Tripp County. The 2008 habitat assessment identified suitable habitat crossed by the Project within this county. Further presence/absence trapping and trap and relocate measures are not recommended by the USFWS (Appendix F – Agency Consultation).

Surveys for the piping plover and interior least tern were conducted in July 2008 along the Cheyenne River as recommended by the USFWS (Appendix F – Agency Correspondence). Surveys did not identify any nesting piping plovers or interior least terns but did identify suitable habitat within the Cheyenne River crossing (Appendix F – Tern/Plover Survey Report). Further nesting surveys for the piping plover and interior least tern are proposed prior to construction should construction be scheduled during the breeding season (15-April to 15-August) or the HDD construction method is not utilized.

Surveys for nesting and roosting bald eagles occurred along the entire route in April 2008. No bald eagle nest or roost sites were identified within 0.25 mile from the ROW in SD (Appendix F Raptor Surveys).

Steele City Segment - Nebraska

A total of 13 special status species (black-footed ferret, river otter, bald eagle, whooping crane, piping plover, interior least tern, finescale dace, northern redbelly dace, blacknose shiner, massasauga, American burying beetle, Western prairie fringed orchid, and small white lady's-slipper could potentially occur within suitable habitat along the proposed route in Nebraska.

Based on correspondence and consultation on May 5, 2008 with the NGPC and the USFWS, species specific surveys will be required for 10 species (see Appendix F).

Surveys for the American burying beetle were initiated in August 2008 with the completion of a habitat assessment (Appendix F – ABB Survey Report). Known historic occurrence data exists along the Project route in Keya Paha, Rock, Holt, Wheeler, and Greeley Counties. The 2008 habitat assessment identified suitable habitat crossed by the Project within these counties. Further presence/absence trapping is scheduled for August 2009. The results of the surveys proposed for 2009 will determine the need for additional trap and relocate measures prior to construction.

Surveys for the piping plover and interior least tern were conducted in July 2008 along the Platte, Loup, and Niobrara Rivers as recommended by the USFWS (Appendix F – Agency Correspondence). Surveys identified one foraging piping plover along the Niobrara River but no nesting piping plovers or least terns were identified during the 2008 surveys (Appendix F – Tern/Plover Survey Report). Further nesting surveys for the piping plover and interior least tern are proposed prior to construction should construction be scheduled during the breeding season (15-April to 15-August) and the HDD construction method is not utilized.

Kansas – Keystone Cushing Extension Pump Stations

Because the two new pump stations are location on agricultural land, and native habitat is limited to non-existent, it is unlikely that sensitive species will be impacted. If the USFWS and/or Kansas wildlife agencies require surveys for sensitive species, they will be conducted in 2009.

Gulf Coast Segment - Oklahoma

Along the proposed route of the Gulf Coast Segment in Oklahoma, a total of five special status wildlife species (bald eagle, interior least tern, piping plover, whooping crane, and American burying beetle) and nine wildlife species of special concern (Bachman's sparrow, Texas horned lizard, Eastern harvest mouse, marsh rice rat, mountain lion, woodchuck, mole salamander, Oklahoma cave amphipod, and prairie mole cricket) potentially could occur within suitable habitat.

Based on correspondence and consultations with the ODWC and the USFWS, surveys would be required for the bald eagle, interior leaste tern, active and inactive raptor nests, and rookeries (i.e. herons and egrets) (ODWC 2008, USFWS 2008b)(see Appendix F). The presence of potential habitat for T&E species was evaluated during the biological surveys conducted in 2008.

As part of the ongoing assessment of potential habitat and existence of the American burying beatle, consultations and discussions are on going with the USFWS to determine the appropriate method of assessing and avoiding impacts in the event the habitat or species are identified to occur within the project area.

Aerial raptor surveys occurred via helicopter within one mile form the edge of the construction ROW to identify active and inactive nest sites along the Project route, including bald eagle nests. Rookeries of species, such as herons and egrets, also will be identified during these surveys. Initial surveys occurred on March 24-26, 2008 and additional surveys are planned for February/March 2009, as well as prior to construction, if construction occurs during the nesting period (January through August). The results of the March 2008 aerial surveys can be found in Table 3.7-5 and in Appendix F. The species was not determined for many of the nests identified in the March 2008 surveys as there were no adults in the vicinity of these nests during surveys. It is likely that the surveys occurred too late in the season and survys will occur earlier in the season in 2009.

Table 3.7-5 Results of March 2008 Aerial Surveys for the Gulf Coast Segment and Houston Lateral

Species	MP	Distance (feet), direction from Centerline
Gulf Coast Segment - Oklahoma		
Raptor (*Buteo* sp.) sighting	22.8	1,055, E
Unidentified nest	28.4	255, W
Unidentified nest	28.8	125, W
Raptor (*Buteo* sp.) sighting and nest	29.3	75, E
Unidentified nest	36.8	3,290, E
Unidentified nest	44.4	17, W
Unidentified nest	75	1,175, W
Unidentified nest	75	4,335, W
Unidentified nest	104.8	87, W
Unidentified nest	141.8	50, W
Gulf Coast Segment - Texas		
Unidentified nest	155.2	1,050, E

Table 3.7-5 Results of March 2008 Aerial Surveys for the Gulf Coast Segment and Houston Lateral

Species	MP	Distance (feet), direction from Centerline
Unidentified nest	155.4	2,635, E
Unidentified nest	155.8	4.875, E
Unidentified nest	159.6	5,200, SW
Unidentified nest	164.7	223, W
Unidentified nest	203.1	75, W
Raptor (*Buteo* sp.) sighting and nest	206.1	20, W
Raptor (*Buteo* sp.) sighting and nest	213.6	325, W
Bald eagle sightings	262 - 361	Various locations
Unidentified nest	277.9	400, W
Great blue heron rookery	300.3	890, W
Great blue heron rookery	309.3	3,385, E
Great blue heron rookery	368.3	855, E
Houston Lateral - Texas		
Great blue heron and roseate spoonbill rookery	9.8	587, E
Unidentified nest	18.3	1,390, NW

Gulf Coast Segment - Texas

A total of thirty special status wildlife species (black bear, Louisiana black bear, Rafinesque's big-eared bat, American peregrine falcon, Arctic peregrine falcon, Bachman's sparrow, bald eagle, brown pelican, Eskimo curlew, interior least tern, piping plover, reddish egret, red-cockaded woodpecker, swallow-tailed kite, white-faced ibis, white-tailed hawk, whooping crane, wood stork, Houston toad, Salado salamander, Louisiana pine snake, Northern scarlet snake, smooth green snake, American burying beetle, Texas horned lizard, timber rattlesnake, Neches River rose-mallow, Texas golden gladecress, Texas prairie dawn-flower, and Texas trailing phlox) potentially could occur within suitable habitat along the proposed Gulf Coast Segment (see Appendix F). Additionally, rookeries potentially could occur within suitable habitat along the proposed Gulf Coast Segment.

Based on correspondence and consultations with the TPWD and the USFWS (TPWD 2008a, USFWS 2008c, USFWS 2008d, USFWS 2008e), surveys would be required for the bald eagle, reddish egret, American Burying beetle, Texas Prairie dawn-flower, active and inactive raptor nests, and rookeries (i.e. herons and egrets). The presence for potential habitat for sensitive species was evaluated during the standard biological surveys conducted in 2008 (see Appendix F).

Aerial raptor surveys will occur via helicopter within one mile form the edge of the construction ROW to identify active and inactive nest sites along the Project route, including bald eagle nests. Rookeries of species, such as herons and egrets, also will be identified during these surveys. Initial surveys occurred on March 24-26, 2008 and additional surveys are planned for February/March 2009, as well as prior to construction, if construction occurs during the nesting period (January through August). The results of the March 2008 aerial surveys can be

found in Table 3.7-5 and in Appendix F. As stated above, due to the number if unidentified nests, surveys will occur earlier in the season in 2009.

The USFWS confirmed that there were no known red-cockaded woodpecker nests or potential habitat for red-cockaded woodpecker nests within the survey corridor (USFWS 2008e).

Houston Lateral - Texas

A total of 21 special status wildlife species (black bear, Louisiana black bear, Rafinesque's big-eared bat, American peregrine falcon, Arctic peregrine falcon, Bachman's sparrow, bald eagle, brown pelican, interior least tern, piping plover, reddish egret, red-cockaded woodpecker, white-faced ibis, whooping crane, wood stork, Houston toad, Louisiana pine snake, Northern scarlet snake, Texas horned lizard, timber rattlesnake, and Texas prairie dawn-flower) potentially could occur within suitable habitat along the proposed Houston Lateral. Additionally, rookeries potentially could occur within suitable habitat along the proposed Houston Lateral.

Based on correspondence and consultations with the TPWD and the USFWS (TPWD 2008a, USFWS 2008c, USFWS 2008d, USFWS 2008e), surveys would be required for the bald eagle, active and inactive raptor nests, rookeries (i.e. herons and egrets), and the Texas prairie dawn-flower. The presence for potential habitat for sensitive species was evaluated during the standard biological surveys conducted in 2008 (see Appendix F).

Aerial raptor surveys occurred via helicopter within one mile form the edge of the construction ROW to identify active and inactive nest sites along the Project route, including bald eagle nests. Rookeries of species, such as herons and egrets, were to be identified during these surveys. Initial surveys occurred on March 24-26 2008 and additional surveys are planned for February/March 2009, as well as prior to construction, if construction occurs during the nesting period (January through August). The results of the March 2008 aerial surveys can be found in Table 3.7-5.

The USFWS confirmed that there were no known red-cockaded woodpecker nests or potential habitat for red-cockaded woodpecker nests within the survey corridor (USFWS 2008e).

3.7.3.3 Aquatic Species

Sensitive aquatic species identified as potentially occurring in waterbodies crossed by the proposed Project include fish species. As identified in Appendix F, potential occurrences of federal and state-listed special status include 20 fish species. The lists were based on NHP data for each state, as well as information obtained from state and federal agencies. Habitat information as well as occurrence by state is provided in Appendix F.

Steele City Segment - Montana

Cherry Creek, the Milk River, the Missouri River, the Redwater River, the Yellowstone River and Boxelder Creek all contain unique habitat for aquatic species. These are the Sicklefin Chub, Sturgeon Chub, Shortnose Gar, Sauger, Blue Sucker, Redbelly Finescale Dace and Paddlefish. Finally, the Pallid Sturgeon, a USFWS endangered species is present in the Milk River, the Missouri River, and the Yellowstone River. The Milk River is one of the few remaining habitats that support a self-sustaining population of Paddlefish. The other streams in Montana that will be crossed by the Project are classified as "expected", meaning that they contain common aquatic species.

Table 3.7-6 Summary of Special Status Wildlife Species Potentially Occurring Within the Project

Species	Status	Montana	South Dakota	Nebraska	Oklahoma	Texas
Mammals						
Marsh Rice Rat *Oryzomys palustris*	OK-SC				X	
Mountain Lion *Puma concolor*	OK-SC				X	
Woodchuck *Marmota monax*	OK-SC				X	
Eastern Harvest Mouse *Reithrodontomys humulis*	OK-SC				X	
Townsend's Big-eared Bat *Corynorhinus townsendii*	MT-SC; BLM-S	X				
Long-legged Myotis *Myotis volans*	MT-SC; BLM-S	X				
Meadow Jumping Mouse *Zapus hudsonius*	MT-SC	X				
Preble's Shrew *Sorex preblei*	MT-SC	X				
Black-footed Ferret *Mustela nigripes*	FE; BLM-SS; MT-SC; SD-E; NE-E	X	X	X		
Black-tailed Prairie Dog *Cynomys ludovicianus*	MT-SC; BLM-S	X				
Swift Fox *Aulpes velox*	MT-SC; BLM-S; SD-T	X	X			
River Otter *Lontra Canadensis*	SD-T; NE-T		X	X		
Black Bear *Ursus americanus*	FT/SA; TX-T					X
Louisiana Black Bear *Ursus americanus luteolus*	FT; TX-T					X
Rafinesque's Big-eared Bat *Corynorhinus rafinesquii*	TX-T					X

Table 3.7-6 Summary of Special Status Wildlife Species Potentially Occurring Within the Project

Species	Status	Montana	South Dakota	Nebraska	Oklahoma	Texas
Red Wolf *Canis rufus*	FE; TX-E					X
West Indian Manatee *Trichechus manatus*	FE; TX-E					X
Birds						
American Peregrine Falcon *Falco peregrinus anatum*	F DM; TX-E					X
American White Pelican *Pelecanus erthrorhynchos*	MT-SC	X				
Arctic Peregrine Falcon *Falco peregrinus tundrius*	F DM; TX-T					X
Bachman's Sparrow *Aimophila aestivalis*	OK-SC, TX-T				X	X
Baird's Sparrow *Ammondramus bairdii*	MT-SC; BLM-S	X				
Bald Eagle *Haliaeetus leucocephalus*	F DM; OK-E, TX-T	X	X	X	X	X
Boblink *Dolichonyx oryzivorus*	MT-SC	X				
Brewer's Sparrow *Spizella breweri*	MT-SC; BLM-S	X				
Brown Pelican *Pelecanus occidentalis*	FE; TX-E					X
Burrowing Owl *Athene cunicularia*	MT-SC; BLM-S	X				
Caspian Tern *Hyrdoprogne caspia*	MT-SC	X				
Chestnut-collared Longspur *Calcarius ornatus*	MT-SC; BLM-S	X				
Common Loon *Gavia immer*	MT-SC; BLM-S	X				
Common Tern *Sterna hirundo*	MT-SC	X				
Dickcissel *Spiza Americana*	MT-SC; BLM-S	X				

Table 3.7-6 Summary of Special Status Wildlife Species Potentially Occurring Within the Project

Species	Status	Montana	South Dakota	Nebraska	Oklahoma	Texas
Eastern Bluebird *Sialia sialis*	MT-SC	X				
Eskimo Curlew *Numenius borealis*	FE; TX-E					X
Ferruginous Hawk *Buteo regalis*	MT-SC; BLM-S	X				
Franklin's Gull *Larus pipixcan*	MT-SC; BLM-S	X				
Grasshopper Sparrow *Ammodramus savannarum*	MT-SC	X				
Golden Eagle *Aquila chrysaetos*	MT-SC; BLM-S	X				
Greater Sage Grouse *Centrocercus urophasianus*	MT-SC; BLM-S	X				
Harlequin Duck *Histrionicus histrionicus*	MT-SC; BLM-S	X				
Interior least tern *Stema antillarum athalassos*	FE; OK-E, TX-E	X	X	X	X	X
Lark Bunting *Calamospiza melanocorys*	MT-SC	X				
Loggerhead shrike *Landius ludovicianus*	MT-SC ; BLM-S	X				
Long-billed Curlew *Numenius americanus*	MT-SC ; BLM-S	X				
Marbled Godwit *Limosa fedoa*	MT-SC; BLM-S	X				
McCown's Longspur *Calcarius mccownii*	MT-SC ; BLM-S	X				
Mountain Plover *Charadrius montanus*	MT-SC ; BLM-S	X				
Northern Goshawk *Accipiter gentilis*	MT-SC; BLM-S	X				
Peregrine Falcon *Falco peregrinus*	MT-SC ; BLM-S ; SD-E	X	X			

Table 3.7-6 Summary of Special Status Wildlife Species Potentially Occurring Within the Project

Species	Status	Montana	South Dakota	Nebraska	Oklahoma	Texas
Piping Plover *Charadrium melodus*	FT ; OK-T, TX-T	X	X	X	X	X
Reddish Egret *Egretta rufescens*	TX-T					X
Red-cockaded Woodpecker *Picoides borealis*	FE, TX-E					X
Red-headed Woodpecker *Melanerpes erthrocephalus*	NT-SC ; BLM-S	X				
Sawinson's Hawk *Buteo swainsoni*	MT-SC ; BLM-S	X				
Sprague's Pipit *Anthus spragueii*	MT-SC ; BLM-S	X				
Swallow-tailed Kite *Elanoides forficatus*	TX-T					X
White-faced Ibis *Plegadis chihi*	TX-T	X				X
White-tailed Hawk *Buteo albicaudatus*	TX-T					X
Whooping Crane *Grus Americana*	FE; OK-E, TX-E	X	X	X	X	X
Willet *Tringa semipalmata*	MT-SC; BLM-S	X				
Wilson's Phalarope *Phalaropus tricolor*	MT-SC; BLM-S	X				
Wood stork *Mycteria Americana*	TX-T					X
Yellow Rail *Coturnicops noveboracensis*	MT-SC; BLM-S	X				
Rookeries (i.e. herons and egrets)	OK-SC, TX-SC				X	X
Amphibians						
Houston Toad *Bufo houstonensis*	FE; TX-E					X
Great Plain Toad *Bufo cognatus*	MT-SC; BLM-S	X				
Mole Salamander	OK-SC				X	

Table 3.7-6 Summary of Special Status Wildlife Species Potentially Occurring Within the Project

Species	Status	Montana	South Dakota	Nebraska	Oklahoma	Texas
Ambystoma talpoideum						
Northern Leopard Frog *Rana pipiens*	MT-SC; BLM-S	X				
Plains Spadefoot *Spea bombifrons*	MT-SC; BLM-S	X				
Salado Salamander *Eurycea chisholmensis*	FC					X
Reptiles						
Alligator Snapping Turtle *Macrochelys temminckii*	OK-SC, TX-T				X	X
Atlantic Hawksbill Sea Turtle *Eretmochelys imbricata*	FE					X
Common Sagebrush Lizard *Isceloporus graciosus*	MT-SC	X				
Greater Short-horned Lizard *Phrynosoma hernandesi*	MT-SC	X				
Green sea Turtle *Chelonia mydas*	FT					X
Kemp's ridley Sea Turtle *Lepidochelys kempii*	FE					X
Leatherback Sea Turtle *Dermochelys coriacea*	FE					X
Loggerhead Sea Turtle *Caretta caretta*	FT					X
Louisiana Pine Snake *Pituophis ruthveni*	FC; TX-T					X
Massasauga *Sistrus catenatus*	NE-T			X		
Milksnake *Lampropeltis triangulun*	MT-SC; BLM-S	X				
Northern Scarlet Snake *Cemophora coccinea copei*	TX-T					X
Smooth Green Snake *Liochlorophis vernalis*	TX-T					X

Table 3.7-6 Summary of Special Status Wildlife Species Potentially Occurring Within the Project

Species	Status	Montana	South Dakota	Nebraska	Oklahoma	Texas
Snapping Turtle *Chekydra serpentine*	MT-SC	X				
Spiny Softshell *Apalone spinifera*	MT-SC; BLM-S	X				
Texas horned lizard *Phrynosoma cornutum*	OK-SC, TX-T				X	X
Timber/Canebrake Rattlesnake *Crotalus horridus*	TX-T					X
Western Hog-nosed Snake *Heterodon nasicus*	MT-SC; BLM-S	X				
Invertebrates						
American Burying Beetle *Nicrophorus americanus*	FE; OK-E; FE; SD-SC; NE-E		X	X	X	X
Ouachita Rock Pocketbook *Arkansia wheeleri*	FE; TX-E					X
Oklahoma Cave Amphipod *Allocrangonyx pellucidus*	OK-SC				X	
Prairie Mole Cricket *Gryllotalpa major*	OK-SC				X	
Plants						
Bittersweet *Celastrus scandens*	MT-SC	X				
Blue Toadflax *Nuttallanthus texanus*	MT-SC	X				
Bractless Mentzelia *Mentzelia thermalis*	MT-SC; BLM-S	X				
Chaffweed *Centunculus minimus*	MT-SC; BLM-S	X				
Crawe's Sedge *Carex crawei*	MT-SC; BLM-S	X				
Geyer's Milkvetch *Astragalus geyeri*	MT-SC; BLM-S	X				
Hot Spring Phacelia *Phacelia thermalis*	MT-SC	X				

Table 3.7-6 Summary of Special Status Wildlife Species Potentially Occurring Within the Project

Species	Status	Montana	South Dakota	Nebraska	Oklahoma	Texas
Narrowleaf Penstemon *Penstemon angustifolius*	MT-SC; BLM-S	X				
Neches River Rose-mallow *Hibiscus dasycalyx*	FC					X
Nine-anther Dalea *Dalea enneandra*	MT-SC	X				
Persistent-sepal Yellow-cress *Rorippa calycina*	MT-SC; BLM-S	X				
Plains Phlox *Phlox andicola*	MT-SC; BLM-S	X				
Poison Suckleya *Suckleya suckleyana*	MT-SC	X				
Raceme Milkvetch *Astragalus racemosus*	MT-SC	X				
Sand Cherry *Prunus pumila*	MT-SC	X				
Showy Prairie-gentian *Eustoma grandiflorum*	MT-SC	X				
Small white lady's-slipper *Cypripedium candidum*	NE-T			X		
Texas Golden Gladecress *Leavenworthia texana*	FC					X
Texas Prairie Pawn-flower *Hymenoxys texana*	FE; TX-E					X
Texas Trailing Phlox *Phlox nivalis texensis*	FE; TX-E					X
Western Prairie Fringed Orchid *Platanthera praeclara*	FT; NE-T			X		
Fish						
Arkansas River Shiner *Notropis girardi*	FT; OK-T				X	
Blacknose Shiner *Notropis heterolepsis*	SD-E; NE-E		X	X		
Blackside Darter *Percina maculata*	TX-T					X

Table 3.7-6 Summary of Special Status Wildlife Species Potentially Occurring Within the Project

Species	Status	Montana	South Dakota	Nebraska	Oklahoma	Texas
Blue Sucker *Cycleptus elongates*	MT-SC; BLM-S	X				
Bluehead Shiner *Pteronotropis hubbsi*	TX-T					X
Blue Sucker *Cycleptus elongates*	TX-T					X
Creek Chubsucker *Erimyzon oblongus*	TX-T					X
Finescale Dace *Phoxinus neogaeus*	NE-T			X		
Longnose Sucker *Catostomus catostomus*	SD-T		X			
Northern Redbelly Dace *Phoxinus eos*	SD-T; NE-T		X	X		
Northern Redbelly X *Phoxinus eos x*	MT-SC; BLM-S	X				
Paddlefish *Polyodon spathula*	MT-SC; BLM-S ; TX-T	X				X
Pallid sturgeon *Scaphirhynchus albus*	FE; MT-SC; BLM-SS	X				
Pearl dace *Margariscus margarita*	MT-SC; BLM-S; SD-T	X	X			
Sauger *Sander Canadensis*	MT-SC; BLM-S	X				
Shortnose Gar *Lepisosteus platostomus*	MT-SC; BLM-S	X				
Shovelnose sturgeon *Scaphirhynchus platorynchus*	OK-SC, TX-T				X	X
Sicklefin Chub *Macrhybopsis meeki*	MT-SC; BLM-S	X				
Smalleye Shiner *Notropis buccula*	FC					X
Sturgeon Chub *Macrhybopsus gelida*	MT-SC; BLM-S; SD-T	X	X			

Table 3.7-6 Summary of Special Status Wildlife Species Potentially Occurring Within the Project

Species	Status	Montana	South Dakota	Nebraska	Oklahoma	Texas
BLM-S = BLM Sensitive BLM-SS = BLM Special Status FE = Federally endangered FT = Federally threatened FC = Federal candidate FT/SA = Federally threatened by similarity of appearance F DM = Delisted, Being monitored first five years MT-SC = Montana Species of Conservation Priority NE-SC = Nebraska Species of Special Concern OK-E = Oklahoma endangered OK-T = Oklahoma threatened OK-SC = Oklahoma species of special concern OK-SC = Oklahoma species of special concern SD-E = South Dakota endangered SD-T = South Dakota threatened SD-SC = South Dakota Species of Concern TX-E = Texas endangered TX-T = Texas threatened TX-SC = Texas species of special concern						

Steele City Segment - South Dakota

Three waterbodies crossed by the proposed route in South Dakota contain known or potential habitat for federally and state-listed species: Cheyenne River (Sturgeon Chub), White River (Sturgeon Chub), and the Keya Paha River (Blacknose Shiner, Northern Redbelly Dace, and Pearl Dace) (SDCWCS 2006).

Steele City Segment - Nebraska

Three speciecs of sensitive fish occur in the prairie streams crossed by this route in Rock County, Nebraska. The blacknose shiner, Northern redbelly dace, and finescale dace occur in Holt Creek and tributaries of the Keya Paha, Niobrara, and South Fork of the Elkhorn Rivers (NGPC 2008 – Meeting Notes).

Keystone Cushing Extension Pump Stations - Kansas

Habitat for the federally listed Topeka shiner is within the general Project area, however, no streams will be impacted by construction of new pump stations.

Gulf Coast Segment - Oklahoma

In the Gulf Coast Segment of the proposed Project area, three special status aquatic species include two fish and one reptile (Arkansas River Shiner, the Shovelnose Sturgeon and the Alligator Snapping Turtle) potentially occurring within suitable habitat in Oklahoma.

Based upon data obtained from agency websites (ODWC 2008, ONHI 2003, USFWS 2007, USFWS 2008) and meetings with agency personnel (USFWS 2008b), a total of three special status aquatic species were identified as potentially occurring within the Gulf Coast Segment in Oklahoma. These species, their associated habitats, and their potential for occurrence along the proposed route are listed and summarized in the Appendix F. Occurrence potential along the proposed Project was evaluated for each species based upon habitat requirements and/or known distribution. Based upon these evaluations, these three species (Arkansas River Shiner, the Shovelnose Sturgeon, and the Alligator Snapping Turtle) could occur in waterbodies crossed by the proposed route. The Arkansas River Shiner has been noted to be present in the South Canadian River and is suspected to be present in the North Canadian River. Based upon conversation with the USFWS in Tulsa, Oklahoma, concern also exists for the presence of the Arkansas River Shiner in the Red River within the Project area. The Shovelnose Sturgeon has known distributions in the Red River and tributaries within the Project area. The Alligator Snapping Turtle has known distribution throughout eastern Oklahoma in slow-moving deep waters of rivers, sloughs, oxbows, lakes or bayous associated with rivers.

Texas – Gulf Coast Segment

In the Gulf Coast Segment of the proposed Project area, eight special status aquatic species include six fish, one invertebrate and one reptile (Blackside Darter, Bluehead Shiner, Blue Sucker, Creek Chubsucker, Paddlefish, Shovelnose Sturgeon, Arkansas Rock Pocketbook and the Alligator Snapping Turtle) potentially occurring within suitable habitat in Texas.

Based upon data obtained from agency websites (TPWD 2008 and USFWS 2008) and meetings with agency personnel (TPWD 2008a, USFWS 2008c, USFWS 2008d and USFWS 2008e), a total of eight special status aquatic species were identified as potentially occurring within the Gulf Coast Segment in Texas. These species, their associated habitats, and their potential for occurrence along the proposed route are listed and summarized in the Appendix F. Occurrence potential along the proposed Project was evaluated for each species based upon habitat requirements and/or known distribution. Based upon these evaluations, these eight species (blackside darter, bluehead shiner, blue sucker, creek chubsucker,

paddlefish, shovelnose sturgeon, Arkansas rock pocketbook and the alligator snapping turtle) could occur in waterbodies crossed by the proposed route. The blackside darter inhabits the red, sulfur and Cypress River basins of northeast Texas within the Project area. The bluehead shiner has a current distribution in northeast Texas that is outside of the Project area and the blue sucker has a known distribution in Texas but not documented within the Project area. The creek chubsucker inhabits tributaries of the Red, Sabine, Neches, Trinity and San Jacinto Rivers in northeast and east Texas. The paddlefish and the shovelnose sturgeon are known to occur in the Red River and tributaries in northeast, east, north and northeast Texas. The mussel, ouachita rock pocketbook, is listed as potentially found in the Red River System. The alligator snapping turtle has known distribution throughout eastern Texas in slow-moving deep waters of rivers, sloughs, oxbows, lakes or bayous associated with rivers within the Project area

Texas –Houston Lateral

In the Houston Lateral Segment, three special status aquatic species include two fish and one reptile (Blue Sucker, Creek Chubsucker and the Alligator Snapping Turtle) potentially occurring within suitable habitat in Texas.

Based upon data obtained from agency websites (TPWD 2008 and USFWS 2008) and meetings with agency personnel (TPWD 2008a, USFWS 2008c, USFWS 2008d and USFWS 2008e), a total of three special status aquatic species were identified as potentially occurring within the Houston Lateral in Texas. These species, their associated habitats, and their potential for occurrence along the proposed route are listed and summarized in the Appendix F. Occurrence potential along the proposed Project was evaluated for each species based upon habitat requirements and/or known distribution. Based upon these evaluations, three species (blue sucker, creek chubsucker and the alligator snapping turtle) could occur in waterbodies crossed by the proposed route. The blue sucker has a known distribution in Texas but not documented within the Project area. The creek chubsucker inhabits tributaries of the Red, Sabine, Neches, Trinity and San Jacinto Rivers in northeast and east Texas. The alligator snapping turtle has known distribution throughout eastern Texas in slow-moving deep waters of rivers, sloughs, oxbows, lakes or bayous associated with rivers within the Project area.

3.8 Land Use

3.8.1 Land Ownership and Use

Table 3.8-1 provides the linear mileage crossed by the proposed route of the Project, categorized by surface ownership. Lands along the Project (shown in Figure 3.8-1) are primarily privately owned. No Tribal lands are crossed by the proposed route (see Section 2.4 for routing constraints). In addition to the federal land listed in Table 3.8-1, the USFWS holds an easement intersected by the proposed route (see Section 3.8.5, Table 3.8-7). Further, state and federal lands of special interest are listed in Section 3.8.5, Table 3.8-6.

Table 3.8-1 Surface Ownership Crossed by the Proposed Project

Ownership Type	Miles Crossed	% of Total Length
Steel City Segment		
Montana		
Federal	42.6	15
State	19.1	7
Private	220.6	78
Montana Subtotal	282.3	

Table 3.8-1 Surface Ownership Crossed by the Proposed Project

Ownership Type	Miles Crossed	% of Total Length
South Dakota		
Federal	0	0
State	20.9	7
Private	291.9	93
South Dakota Subtotal	312.8	
Nebraska		
Federal	0	0
State	0	0
Private	255.2	100
Nebraska Subtotal	255.2	
Gulf Coast Segment		
Oklahoma		
Federal	0.0	
State	1.2	1.0
Private	153.7	99.0
Oklahoma Subtotal	***154.9***	
Texas		
Federal	0.0	0.0
State	0	0.0
Private	323.3	100
Texas Subtotal	***323.3***	
Houston Lateral		
Federal	0	
State	0	
Private	47.2	100
Houston Lateral Subtotal	***47.2***	
Project Total	**1375.7**	

NOTE:Mileage for new pipeline construction only. Does not include disturbance for construction of new pump stations along the Keystone Cushing Extension in Kansas.

This section describes the types of land use that are crossed by the Project. The following overview of land use types within the proposed ROW represents information gathered from publicly available literature, federal, state, and local agencies, review of current aerial photography, and field surveys conducted

between May and August 2008. The information provides a baseline inventory of land usage occurring within the Project area. Land use is classified as the following:

- Developed: lands used for residential areas as well as industrial and commercial areas. Specifically, these areas contain all, but are not limited to houses, structures, roads, railroads, windbreaks, and cleared ROW;
- Agriculture/cropland: land suitable for or used for the cultivation of crops;
- Grassland/Rangeland: land that is occupied by native herbaceous or shrubby vegetation which is grazed by domestic or wild herbivores. Grasslands can be native or improved land;
- Forest Land: land consisting of wooded upland forests. This land is dominated by trees and shrubs and includes areas planted with trees for the pulp and/or paper industry;
- Water: rivers, streams, creeks, bayous, ponds, lakes, etc.;
- Wetlands: low-lying areas of land that are saturated with moisture, especially when regarded as the natural habitat of wildlife. These lands include emergent wetlands, scrub/shrub wetlands, and forested wetlands.

Table 3.8-2 provides the miles crossed, categorized by land use, by the proposed pipeline. The majority of the land use in the Steele City Segment, the pump station locations on the Keystone Cushing Extension and the Gulf Coast Segment is grassland/rangeland. The Houston Lateral lies almost equally in forest land and cropland. Land use types not specifically described here in are discussed in the vegetation and water resources sections (Sections 3.5 and 3.6), respectiively.

Table 3.8-2 Land Use Crossed by the Proposed Project

	Distance (miles)						
	Steele City Segment			Keystone Cushing Extension Pump Stations	Gulf Coast Segment		Houston Lateral
Land Use Type	Montana	South Dakota	Nebraska	Kansas	Oklahoma	Texas	Texas
Developed	3.1	3.0	3.8	0.0	22.5	42.0	4.7
Agriculture/ Cropland/ Grassland /Pastureland	273.7	303.2	239.9	0.0	108.3	147.2	21.0
Forest Land	0.7	0.8	3.8	0.0	44.7	118.9	14.2
Water	3.5	4.2	1.7	0.0	1.2	1.9	0.2
Wetlands	1.3	1.6	5.9	0.0	0.7	13.3	7.1
Total	282.3	312.8	255.2	0.0	154.9	323.3	47.2

NOTE: Mileage for new pipeline construction only. Does not include disturbance for construction of new pump stations along the Keystone Cushing Extension in Kansas. Workspace locations do not reflect environmental survey results.

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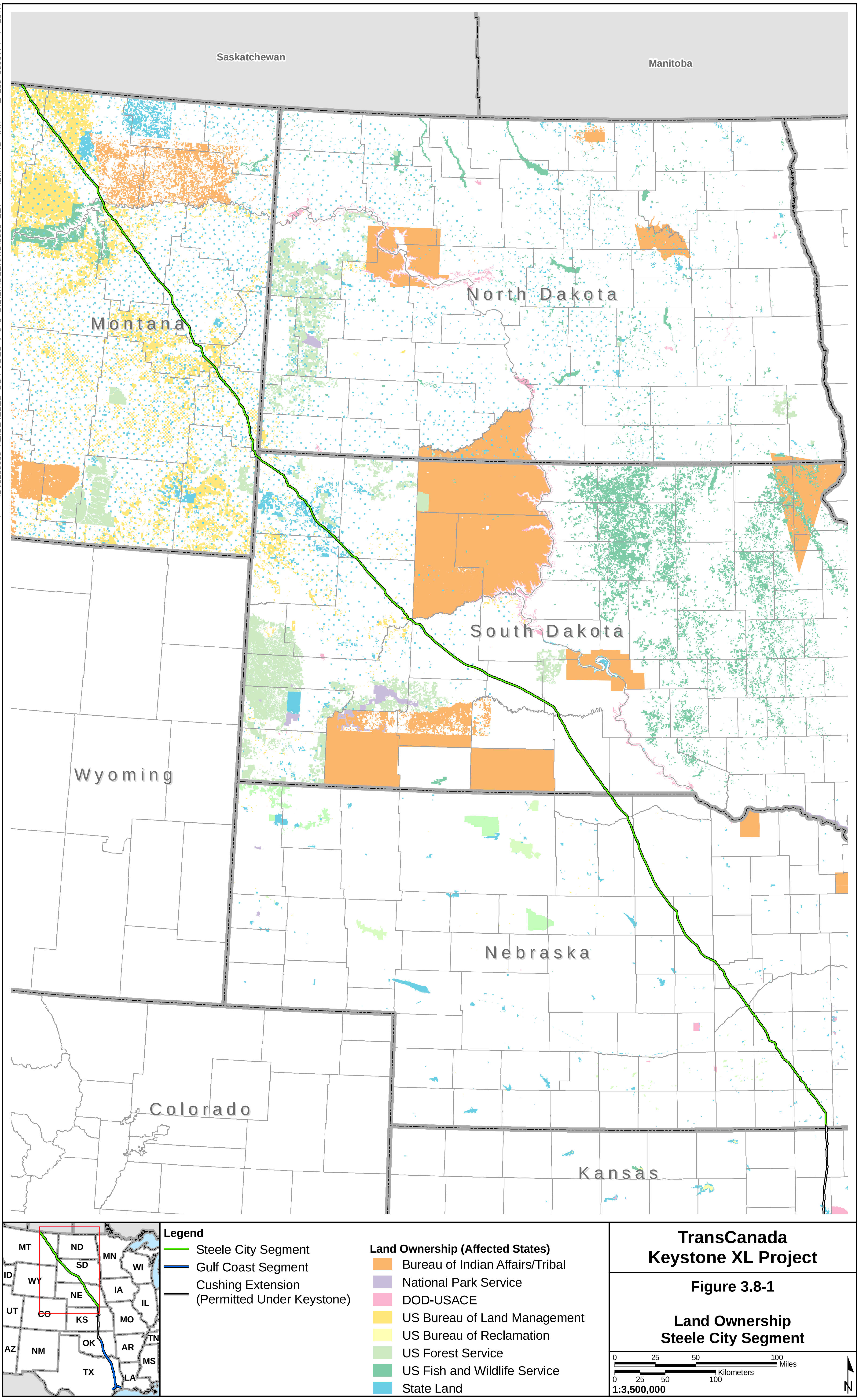
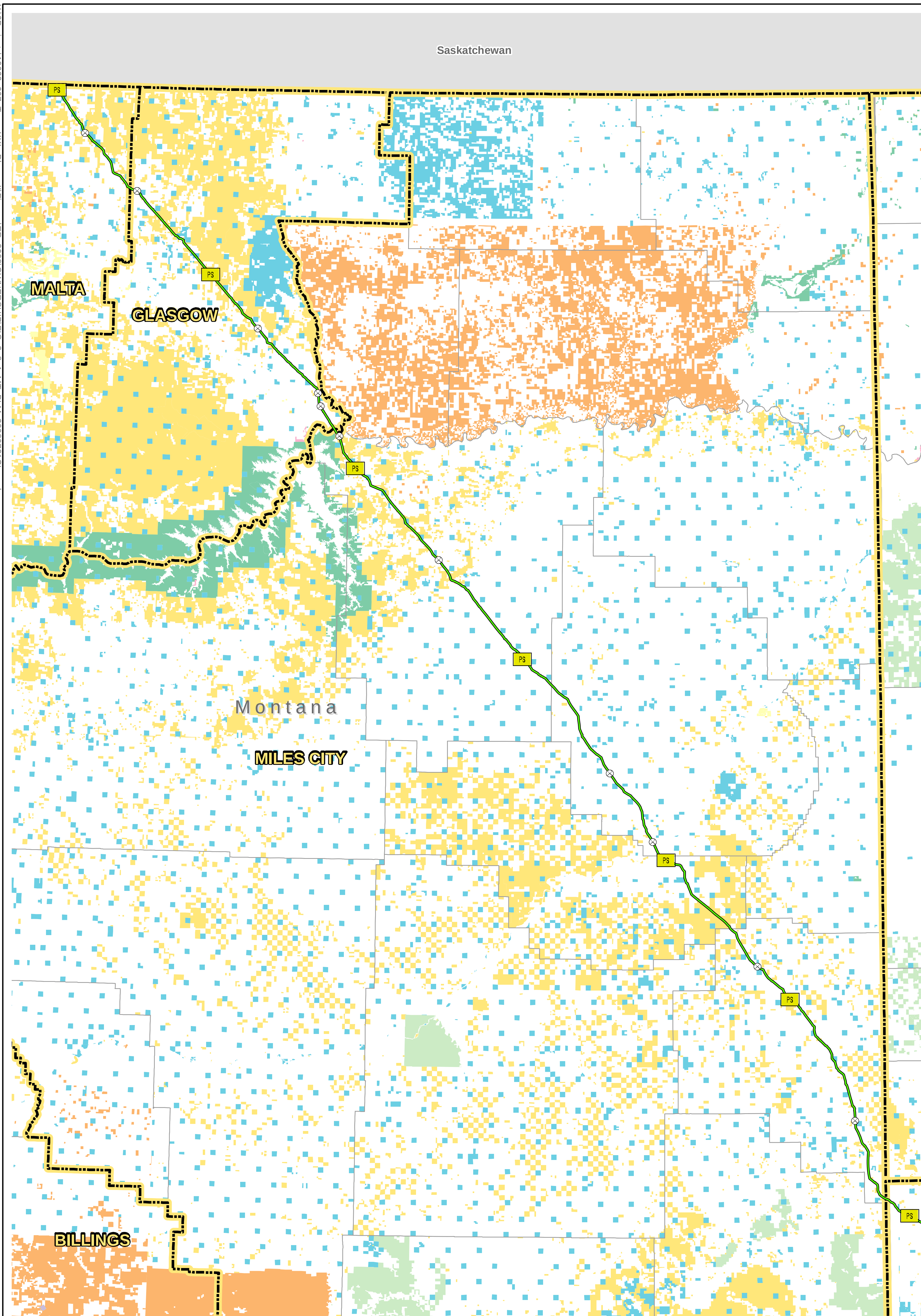
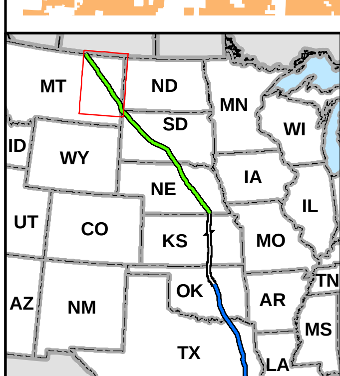


TransCanada Keystone XL Project

Figure 3.8-1

Land Ownership Steele City Segment





Legend

- Valve
- Pump Station
- Steele City Segment
- Gulf Coast Segment
- Cushing Extension (Permitted Under Keystone)
- BLM District

Land Ownership (Affected States)

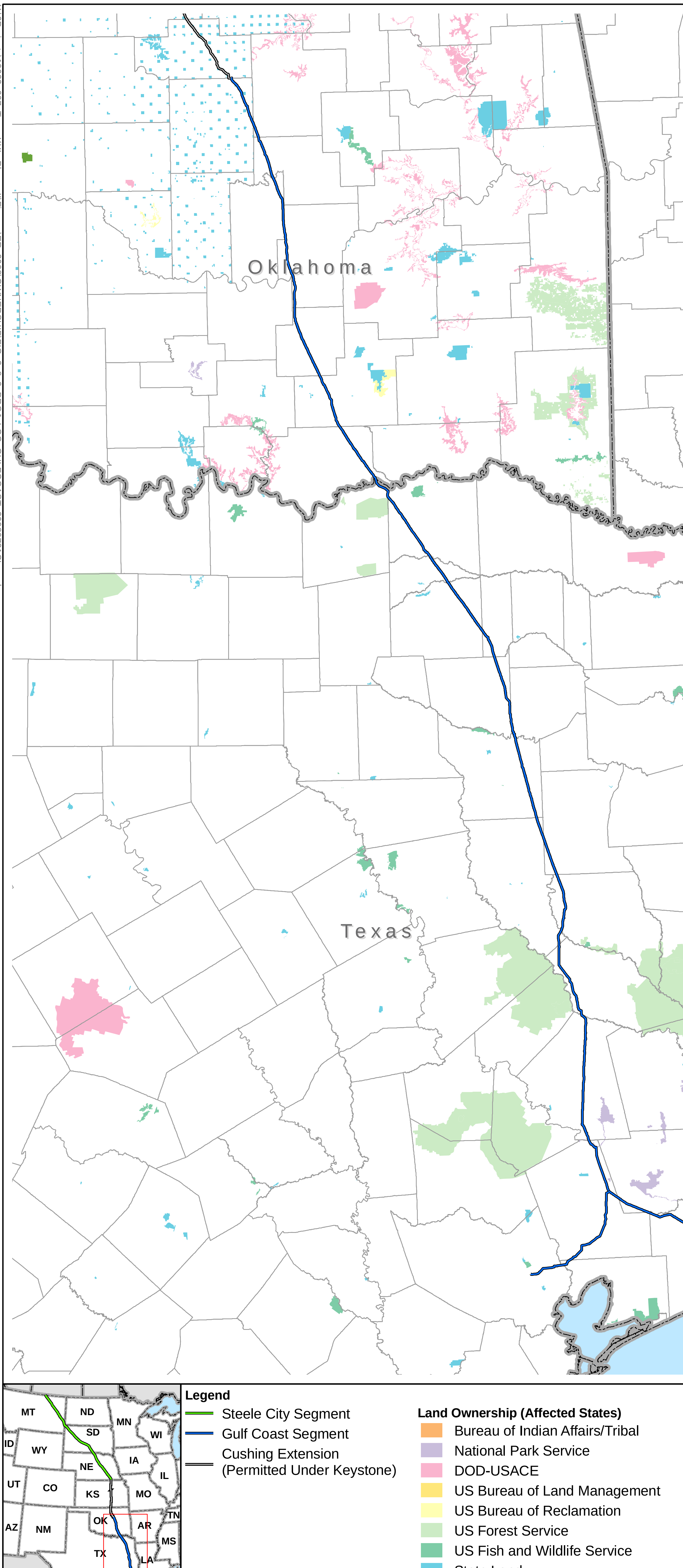
- Bureau of Indian Affairs/Tribal
- National Park Service
- DOD-USACE
- US Bureau of Land Management
- US Bureau of Reclamation
- US Forest Service
- US Fish and Wildlife Service
- State Land

TransCanada
Keystone XL Project

Figure 3.8-1

Montana BLM Districts

0 10 20 40 Miles
0 10 20 40 Kilometers
1:1,200,000
N



TransCanada
Keystone XL Project

Figure 3.8-2

Land Ownership
Gulf Coast Segment

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3.8.2 Developed Land/Residential/Commercial Areas

Table 3.8-3 provides a summary of the residences/residential areas and public assembly places within 50 feet of the Project. Places of public assembly are defined as hospitals, churches, government buildings, and assembly halls, etc. The number of residences within 50 feet of the Project will be defined once the civil surveys can be completed along all areas of the route.

Steele City Segment

Residential areas, commercial areas, and utility crossings represent about 1.2 percent of the Steele City Segment of the proposed Project.

Keystone Cushing Extension Pump Station

Construction of two new pump stations in Kansas will occur on agricultural land.

Gulf Coast Segment

Residential areas, commercial areas, and utility crossings represent approximately 4.4 percent of the Gulf Coast Segment of the Project. Residential areas located adjacent to the proposed pipeline are single family units located in rural subdivisions on small lots.

Houston Lateral

Residential areas, commercial areas, and utility crossings represent approximately 4.0 percent of the Houston Lateral. Residential areas located adjacent to the proposed pipeline are single family units located in rural subdivisions on small lots.

Table 3.8-3. Potential Residences and Public Assembly Places near the Proposed Project

State	Potential Residences or Residential Areas within 50 feet [1]	Public Assembly Places within 50 feet [1]
Montana – Steele City Segment	3	0
South Dakota – Steele City Segment	1	0
Nebraska – Steele City Segment	5	2
Kansas – New Pump Stations on Keystone Cushing Extension	0	0
Oklahoma – Gulf Coast Segment	21	0
Texas – Gulf Coast Segment	96	0
Texas – Houston Lateral	5	0

[1] To be confirmed with field surveys within 50 feet of the proposed ROW.

3.8.3 Grassland/Rangeland/Agriculture

Rangeland is generally described as native grass or shrub land grazed by livestock or wild herbivores. Agriculture/cropland is any land suitable for or used for the cultivation of crops. Along with agricultural land use, the NRCS has determined prime farmland soils have the best combination of physical and chemical

characteristics for producing crops and are available for these uses; however, not all prime farmland soils are used for agricultural purposes. NRCS soil service databases were reviewed to identify potential prime farmland. A more detailed account of soils may be found in Section 3.4.

Steele City Segment

Approximately 31.7 percent of the Steele City Segment crosses croplands. Approximately 64.4 percent of the proposed route crosses grassland/rangeland. With the exception of proposed facilities within existing industrial sites, pump stations will be located on either cropland, or grassland/ rangeland. Some of this land, the extent of which is currently unknown, may be terraced and/or have subsurface drainage systems installed.

Keystone Cushing Extension Pump Stations

Pump stations will be located on cropland.

Gulf Coast Segment

Approximately 7.2 percent of the Gulf Coast Segment crosses agricultural lands. The principal crops grown in Oklahoma that may be crossed by the proposed Project are wheat, hay, rye, corn, soybeans, and oats (NASS, 2006-2007). In Texas crops that may be crossed by the proposed Project are wheat, soybeans, sorghum, corn, oats, cotton, and rice (NASS, 2006-2007).

About 23.4 percent of the Gulf Coast Segment crosses pasture/rangelands. Oklahoma and Texas have a variety of rangelands that are crossed by the Gulf Coast Segment, from crosstimbers to shortgrass prairies (Arnall, 2008). In general though, these lands are primarily native pasturelands which are grazed on by livestock and wild herbivores.

Houston Lateral

Land used for agricultural purposes makes up only 6 percent of the total land use crossed by the Houston Lateral. Crops associated with this area of southern Texas include rice, sorghum, wheat, soybeans, and corn (NASS, 2006-2007). Rangeland consists of approximately 43.6 percent of the land use crossed by the Houston Lateral.

3.8.4 Wetlands and Waterbodies

Steele City Segment

Approximately 13.3 percent of the proposed Project crosses wetland and/or waterbodies in the Steele City Segment.

Keystone Cushing Extension Pump Station

There are no wetland located within the footprint of the pump stations.

Gulf Coast Segment

Approximately 12.9 percent of the Gulf Coast Segment of the proposed Project crosses wetland and/or waterbodies.

Houston Lateral

Land used for wetlands and/or waterbodies makes up only 5.9 percent of the total land use crossed by the Houston Lateral.

3.8.7 Recreation and Special Interest Areas

Recreational and special interest areas include state and national parks and forests, wildlife management areas, wildlife refuges, camping grounds, RV parks, hiking and equestrian trails, and golf courses. Recreation and special interest areas crossed by the proposed pipeline are listed in Table 3.8-6. No national parks or forests are crossed by the centerline.

Table 3.8-7 lists USFWS Wetland Easements crossed by the proposed pipeline. These are areas having permanent protection from conversion of natural land cover for the majority of the area, but subject to extractive uses of either a broad, low-intensity type (e.g., logging) or localized intense type (e.g., mining). It also confers protection to federally listed endangered and threatened species throughout the area.

At present, there is only one known NRCS easement crossed by the proposed route. Similar to USFWS easements, these areas have long-term or permanent protection for areas the landowner has restored to natural land cover type with NRCS funding assistance. Precise location information was not available, but more general information by state was provided by the agency.

Conservation Reserve Program (CRP) and Wetland Reserve Program (WRP) are also areas of special interest. The CRP provides technical and financial assistance to eligible farmers and ranchers to address natural resources concerns on their lands. The program provides cost sharing to establish practices that focus on reducing soil erosion, improving water quality, enhancing forest and wetlands resources and establishing wildlife habitat. Once practices are in place, landowners receive annual rental payments for the term of the multi-year contract. The WRP is a voluntary program offering landowners the opportunity to protect, restore, and enhance wetlands on their property. The NRCS provides technical and financial support to help landowners with their wetland restoration efforts. The goal is to achieve the greatest wetland functions and values, along with optimum wildlife habitat, on every acre enrolled in the program. This program offers landowners an opportunity to establish long-term conservation and wildlife practices and protection. (NRCS, CRP)

WSAs are roadless areas that have been inventoried and found to have wilderness characteristics as described in the Federal Land Policy and Management Act (FLPMA) and the Wilderness Act of 1964 (BLM, 2007b). FLPMA directed the BLM to study the agency's roadless areas and recommend those that should be designated as wilderness. The BLM inventoried the lands it manages in order to identify areas with the basic wilderness characteristics described in the Wilderness Act of 1964. Public lands that had wilderness characteristics were designated as WSAs and are managed to protect these wilderness values until Congress decides the future of these areas (BLM, 2007b).

The Wild and Scenic Rivers Act of 1968 strives to balance river development with permanent protection for the most free-flowing rivers of the United States. The Act specifically prohibits dams and other federally assisted water resources Projects that would adversely affect river values, protects outstanding natural, cultural, or recreational values, ensures water quality is maintained, and requires the creation of a comprehensive river management plan that addresses resource protection, development of lands and facilities, user capacities, and other management practices necessary to achieve purposes of the Act (NWSRS, 2008).

Steele City Segment

The Steele City segment crosses a number of special interest areas including BLM property; Montana State Trust Lands; South Dakota Game, Fish and Park lands; and South Dakota State School lands in multiple places. See Table 3.8-4 below.

Montana

The Project crosses approximately 42.6 miles of federal lands in Montana. Approximately 42.2 miles are lands under BLM jurisdiction, including lands overseen by the Malta, Glasgow, and Miles City Field Offices (Figure 3.8-1). These field offices are required to manage public lands under their jurisdiction according to the following resource management plans (RMP's); the Big Dry (1994) and Powder River (1985) RMP's for eastern Montana, and the Judith Valley Phillips RMP for counties in northern Montana. The BLM lands in the Project area are predominantly composed of grasslands utilized by farmers for their livestock (Bloom 2008), with lease agreements in place according to the RMPs. Construction and operation of the Project is consistent with the stipulations listed by the BLM resource management plans and with current land uses, with the exception of Fallon County. While some restrictions to pipelines exist on portions of public lands in southern Fallon County are the Project does not cross any lands where these rescrictions are in effect. Although the Project does not cross large portions of BLM lands in this area, any restrictions that will apply to this Project will be determined through consultation during the NEPA process. New RMP's are currently being developed by the BLM for lands within the Project area; however, they will be condensed into two RMP's (Malta and Miles City) and will not be available for a few years.

A component of land use specific to federally managed lands is visual resources, which are those characteristics of the landscape visible to residents and visitors. There are no formal guidelines for managing visual resources for private or state owned lands, except for consideration during the state-level permitting process (Major Facilities Siting Act, or MFSA) in Montana. Descriptions of visual resources include the aesthetic value of the natural and developed landscape, the public value of viewing the natural landscape, and the visibility of the landscape from sensitive viewpoints (e.g., residences, recreation areas, rivers, and highways). Documentation of potential visual effects of the pipeline includes evaluation of physical features of the landscape, with particular attention to the ability of the particular landscape to absorb the visual modifications that would be introduced, together with the level of concern, or sensitivity, people have for scenic quality. Together these factors define the degree of landscape modification that would acceptable. The BLM is responsible for identifying and protecting scenic values on public lands under several provisions of the Federal Land Policy Management Act (FLPMA) and the National Environmental Policy Act (NEPA). The BLM Visual Resource Management (VRM) system was developed to facilitate the effective discharge of that responsibility in a systematic, interdisciplinary manner.

The VRM system, documented by the BLM in the 8400 series VRM Manual (BLM 1984), was used as the basis for both the visual resources inventory and the assessment of visual impacts of proposed Project route alternatives. The VRM system includes an inventory process, based on a matrix of scenic quality, viewer sensitivity to visual change, and viewing distances, which leads to classification of public lands and assignment of visual management objectives. Four VRM classes have been established, which serve two purposes: 1) as an inventory tool portraying relative value of existing visual resources and 2) as a management tool portraying visual management objectives for the respective classified lands to establish the guidelines for the level of acceptable visual change allowed in the landscape. The management objectives for each of the VRM classes are displayed in Table 3.8-4.

The VRM system also includes a "contrast rating" procedure for evaluating the potential visual effects of a proposed Project or management activity. The VRM system was used to evaluate the visual impact of the proposed Project on BLM lands as well as the potential cumulative visual effects of the Project in the context of other activities that have taken place or may take place in the area in the reasonably foreseeable future (Table 3.8-5).

Table 3.8-4 Bureau of Land Management Visual Resource Management Class Objectives

Class I Objective	The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.
Class II Objective	The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic (design) elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
Class III Objective	The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
Class IV Objective	The objective of this class is to provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic (design) elements.
Rehabilitation Areas	Areas in need of rehabilitation from a visual standpoint should be flagged during the inventory process. The level of rehabilitation will be determined through the resource management planning (RMP) process by assigning the VRM class approved for that particular area.

Source: BLM (1986).

Table 3.8-5 VRM Classes on Federal Lands

Federal Lands Crossed	From MP[1]	To MP[1]	Miles by VRM Class			
			Class II	Class III	Class IV	Total
BLM	0.00	12.0			12.0	12.0
BLM	12.0	25.7	13.7			13.7
BLM	25.7	35.1			9.4	9.4
BLM	35.1	43.4	8.3			8.3
BLM	43.4	68.1			24.7	24.7
None	68.1	71.1		3.0		3.0
BLM	71.1	78.9			7.8	7.8
None	78.9	80.8		1.9		1.9
None	80.8	84.1	3.3			3.3
None	84.1	86.9			2.8	2.8
BLM, Department of Defense	86.9	91.3	4.4			4.4
BLM	91.3	92.9			1.6	1.6
BLM	92.9	103.3		10.4		10.4
BLM	103.3	107.9			4.6	4.6
BLM	107.9	109.9		2.0		2.0
BLM	109.9	125.4			15.5	15.5

Table 3.8-5 VRM Classes on Federal Lands

Federal Lands Crossed	From MP[1]	To MP[1]	Miles by VRM Class			
			Class II	Class III	Class IV	Total
BLM	125.4	128.9	3.5			3.5
None	128.9	145.0			16.1	16.1
None	145.0	162.0		17.0		17.0
None	161.9	192.0			30.1	30.1
None	192.0	197.0	5.0			5.0
None	197.0	203.2			6.1	6.1
None	203.2	206.4		3.2		3.2
None	206.4	206.7			0.3	0.3
None	206.7	206.7		<0.1		<0.1
BLM	206.7	243.4			36.7	36.7
BLM	243.4	245.5	2.1			2.1
BLM	245.5	247.2			1.7	1.7
None	247.2	249.5		2.3		2.3
None	249.5	263.8			14.3	14.3
None	263.8	265.8		2.0		2.0
BLM	265.8	282.2			16.4	16.4
Total Miles			40.3	41.8	200.1	282.2
Percent of Total			14.3	14.8	70.9	100.0

[1] See Table 3.8-6 for exact locations of federal lands within the VRM classes.

There is one known USFWS easement crossed by the Project in Montana, and approximately 9.9 miles of land under an estimated 39 CRP contracts. See Table 3.8-6 for a listing of known easements.

South Dakota

There are an estimated 39 CRP contracts (7.3 miles) and no known USFWS easements crossed by the Project in South Dakota. There are 27 CRP contract easements (5.0 miles) crossed in Nebraska. The Wetlands of America Trust, inc., a supporting organization of Ducks Unlimited, has a conservation easement on a 150 acre tract near MP 799 in Nebraska. In Montana there are two easements crossed by the Project: the Phillips County USFWS Wetland Easement and the Cornwell Ranch Conservation Easement (MFWP). See Table 3.8-7 for a listing of known easements.

Nebraska

There are 27 number of CRP contracts crossed by the Project in Nebraska.

The Project does not cross any rivers in reaches that have a wild and scenic designation in the Steele City Segment. In Nebraska, the Project is routed to cross the Niobrara east of the wild and scenic river designated area. Similarly, while the Project crosses the Missouri River, the crossing is not located in an area designated as wild and scenic. No designated wilderness or WSA's are crossed by the proposed Project in the Steele City Segment.

<u>Keystone Cushing Extension Pump Stations</u>

Both new and existing pump stations located on the Keystone Cushing Extension will be situated on private lands.

Gulf Coast Segment

The Gulf Coast Segment of the Project crosses two recreational and special interest areas. A list of these areas may be found in Table 3.8-6. There are no WSA's crossed by the Gulf Coast segment in Oklahoma and Texas (BLM, 2007a and 2008). No wild and scenic rivers are crossed by the Gulf Coast segment of the Project (NWSRS, 2008). There are several CRP's crossed by the proposed route; and two WRP located in Texas.

Houston Lateral

There are no known recreational or special interest areas in the vicinity of the Houston Lateral in Texas. There are no USFWS easements crossed by the Houston Lateral in Texas. There are no CRP or WRP lands crossed by the Houston Lateral in Texas. The Project does not cross any rivers in reaches that have a wild and scenic designation in the Houston Lateral (NWSRS, 2008). No designated wilderness or WSA's are crossed by the Project in the Houston Lateral (BLM, 2008). Recreational lands crossed by the Project are shown in Table 3.8-6 and other easement crossed by the Project is located in Table 3.8-7.

Table 3.8-6 Recreation and Special Interest Areas Crossed by the Project

State	Mileposts	Miles Crossed	Name / Ownership
Steele City Segment			
Montana			
	0.0-0.8	0.8	BLM
	0.8-2.4	1.5	Montana State Trust Lands
	2.4-2.5	0.1	BLM
	2.5-3.7	1.1	Montana State Trust Lands
	5.9-6.2	0.2	BLM
	6.2-7.4	1.2	Montana State Trust Lands
	9.1-9.7	0.6	BLM
	9.7-11.3	1.6	Montana State Trust Lands
	11.3-12.3	0.9	BLM
	12.3-13.0	0.7	Montana State Trust Lands
	13.0-13.8	0.7	BLM
	14.0-15.3	1.2	Montana State Trust Lands
	15.3-15.4	0.0	BLM
	18.8-19.2	0.4	Montana State Trust Lands
	25.2-25.2	0.0	BLM
	28.1-28.4	0.2	Montana State Trust Lands
	29.0-29.0	0.0	BLM
	32.8-35.0	2.2	BLM
	35.4-36.8	1.4	BLM
	37.2-37.5	0.2	BLM
	37.9-39.0	1.1	BLM
	39.0-39.9	0.9	Montana State Trust Lands
	40.5-40.8	0.3	Montana State Trust Lands
	42.5-43.1	0.5	BLM
	43.8-45.2	1.3	Montana State Trust Lands
	45.7-46.9	1.1	BLM

Table 3.8-6 Recreation and Special Interest Areas Crossed by the Project

State	Mileposts	Miles Crossed	Name / Ownership
	47.6-48.4	0.7	BLM
	48.4-49.2	0.8	Montana State Trust Lands
	49.9-52.8	2.9	BLM
	52.8-53.3	0.4	Montana State Trust Lands
	53.3-54.3	1.0	BLM
	54.6-55.1	0.4	BLM
	55.4-56.0	0.5	BLM
	56.7-56.7	0.0	BLM
	57.0-57.4	0.3	BLM
	58.1-61.5	3.3	BLM
	62.3-62.7	0.3	BLM
	63.4-64.2	0.7	BLM
	65.1-65.7	0.6	BLM
	67.8-68.1	0.3	BLM
	77.7-78.4	0.7	Montana State Trust Lands
	88.8-89.0	0.1	Water - navigable (state Dept of Natural Resources
	89.0-89.3	0.3	US Dept of Defense
	89.3-92.0	2.6	BLM
	92.8-94.4	1.5	BLM
	94.7-96.0	1.2	BLM
	96.0-96.7	0.7	Montana State Trust Lands
	98.6-99.0	0.3	BLM
	100.4-101.3	0.8	Montana State Trust Lands
	103.1-103.4	0.2	BLM
	104.9-106.2	1.3	Montana State Trust Lands
	106.2-106.5	0.2	BLM
	106.7-106.9	0.2	BLM
	108.0-108.3	0.3	Montana State Trust Lands
	108.6-109.3	0.6	BLM
	110.0-110.1	0.1	BLM
	111.3-112.0	0.6	BLM
	112.0-113.0	1.0	Montana State Trust Lands
	114.6-115.0	0.4	BLM
	115.7-116.4	0.6	BLM
	116.4-117.3	0.8	Montana State Trust Lands
	117.3-117.4	0.1	BLM
	118.7-119.2	0.5	BLM
	119.3-119.5	0.2	BLM
	121.3-121.3	0.0	Montana State Trust Lands
	126.1-126.1	0.0	BLM
	128.4-128.8	0.4	BLM

Table 3.8-6 Recreation and Special Interest Areas Crossed by the Project

State	Mileposts	Miles Crossed	Name / Ownership
	154.8-154.8	0.0	Montana State Trust Lands
	159.0-159.1	0.0	Montana State Trust Lands
	180.0-180.1	0.1	Montana State Trust Lands
	195.8-195.9	0.0	Water - navigable (state Dept of Natural Resources
	209.1-209.7	0.6	BLM
	210.4-211.0	0.6	BLM
	211.1-217.9	6.7	BLM
	236.6-236.8	0.1	BLM
	246.2-246.9	0.7	BLM
	251.2-251.9	0.6	Montana State Trust Lands
	271.8-272.3	0.4	BLM
South Dakota			
	301.9-302.8	0.8	South Dakota Game, Fish, and Park
	303.8-303.9	0.1	South Dakota Game, Fish, and Park
	308.0-308.3	0.2	South Dakota Game, Fish, and Park
	308.6-309.1	0.5	South Dakota Game, Fish, and Park
	323.2-325.4	2.1	South Dakota Game, Fish, and Park
	326.2-326.7	0.4	South Dakota Game, Fish, and Park
	327.2-328.0	0.7	South Dakota Game, Fish, and Park
	329.7-329.9	0.2	South Dakota Game, Fish, and Park
	330.5-333.0	2.5	South Dakota Game, Fish, and Park
	335.8-335.9	0.0	South Dakota Game, Fish, and Park
	337.6-337.9	0.3	South Dakota Game, Fish, and Park
	338.8-339.1	0.2	South Dakota Game, Fish, and Park
	339.1-340.5	1.4	South Dakota Game, Fish, and Park
	343.3-344.2	0.8	South Dakota Game, Fish, and Park
	345.4-345.9	0.4	South Dakota Game, Fish, and Park
	346.0-346.5	0.4	South Dakota Game, Fish, and Park
	346.5-346.6	0.0	Water
	346.6-346.7	0.1	South Dakota Game, Fish, and Park
	347.3-347.5	0.2	South Dakota Game, Fish, and Park
	347.6-347.9	0.3	South Dakota Game, Fish, and Park
	349.1-350.1	1.0	South Dakota Game, Fish, and Park
	350.5-350.9	0.3	South Dakota Game, Fish, and Park
	351.3-352.5	1.1	South Dakota Game, Fish, and Park
	352.9-353.5	0.6	South Dakota Game, Fish, and Park
	364.2-364.9	0.6	South Dakota Game, Fish, and Park
	367.0-368.2	1.2	South Dakota Game, Fish, and Park
	368.4-370.3	1.8	South Dakota Game, Fish, and Park
	376.3-376.6	0.2	State School Land
	425.2-425.3	0.0	Water

Table 3.8-6 Recreation and Special Interest Areas Crossed by the Project

State	Mileposts	Miles Crossed	Name / Ownership
	437.3-438.3	1.0	State School Land
	464.4-464.5	0.1	Water
Nebraska			
None			
Kansas - Pump Stations on Keystone Cushing Extension			
None			
Gulf Coast Segment - Oklahoma			
	22.1 – 23.3	1.2	Deep Fork Wildlife Management Area - Oklahoma Department of Wildlife Conservation
Gulf Coast Segment - Texas			
None			
Houston Lateral - Texas			
None			

Table 3.8-7 USFWS, NRCS and other Easements Crossed by the Proposed Project

Easement	Mileposts	Miles Crossed
Steele City Segment		
Montana		
Cornwell Ranch Conservation Easement (MFWP)	TBD	3.0
Phillips County USFWS Wetland Easement	4.2 – 5.0	0.8
CRP Contract Land	Multiple	9.9
South Dakota		
Wetlands of America Trust, inc.	Near 799	TBD
CRP Contract Land	Multiple	7.3
Nebraska		
CRP Contract Land	Multiple	5.0
Texas		
CRP Contract Land	Multiple	TBD
WRP Contract Land	Multiple	TBD

CRP Spatial data provided by Farm Service Agency (FSA) offices in Montana, Nebraska, and South Dakota.

CRP data provided by FSA county offices, WRP information provided by NRCS Texas State Office

3.8.5 Noise

The existing noise environment is characterized by determining ambient noise levels, identifying existing noise sources, identifying noise sensitive receptors in the vicinity of project noise sources, and evaluating local terrain features that may affect noise transmission.

The Project will occur primarily in rural agricultural areas. It is estimated that day-night average levels (L_{dn})[1] on the A weighted scale (dBA)[2] range between 40 dBA (rural residential) and 45 dBA (agricultural cropland) (USEPA 1978). Ambient (background) noise levels occur from roadway traffic, farm machinery on a seasonal basis, pets, and various other household noises. Project areas along major highways and interstates may experience higher ambient noise levels of approximately 68 to 80 dBA (USEPA 1978).

3.9 Cultural Resources

Protection of cultural resources is defined by a series of federal laws designed to manage and protect these national assets from damage or loss due to federally funded or permitted activities. These laws include, but are not limited to, the Antiquities Act of 1906, Historic Sites Act of 1935, Executive Order (EO) 13007, EO 11593, Archaeological and Historic Preservation Act (AHPA) of 1974, Archaeological Resources Protection Act (ARPA) of 1979, and Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended. Together, these federal guidelines provide necessary guidance on the protection of cultural resources.

In compliance with the mandates listed above, cultural resource investigations commenced for the Steele City Segment in April 2008 and for the Gulf Coast Segment and Houston Lateral earlier in 2008 and are ongoing. The description and results of the investigations to date are summarized below.

Steele City Segment - Montana

Results of Record Search

SWCA Environmental Consultants (SWCA) conducted a Class I files/records search from April 14 through 18, 2008, at the Montana SHPO office, and at the BLM Miles City Field Office April 23, 2008. The Class I search yielded 216 previously recorded sites within the two-mile-wide file search corridor centered on the proposed pipeline centerline. Results of this search are included in (Appendix G (Berg et al. 2008a). Sites located through this record search include:

- 62 historic sites: 27 homesteads, nine railroad crossings, five bridges, three canal/irrigation systems, one cemetery, six bridges, two rock alignment/cairn sites, one trading post, two roadway trestles, two foundations, a crossing of the Lewis and Clark Trail, and three unknown site types.
- 148 prehistoric sites: 115 stone circle/stone feature sites, 14 lithic scatters, one animal processing site, four kill sites, 11 cairn sites, two campsites, and, one site which is identified as a Traditional Cultural Property (TCP).
- Six multi-component sites containing both prehistoric and historic features and/or artifacts include: one prehistoric lithic scatter and historic rock cairn site, one prehistoric stone circle and historic dugout site, three stone circle and historic homestead sites, and one prehistoric stone circle and historic rock cairn site.
- Four sites of undetermined age/site type.

Sites recommended as eligible for the National Register of Historic Places (NRHP) include thirteen of the historic sites within the two-mile-wide file search corridor. These sites include the cemetery, seven portions of railroads, two railroad bridges, one bridge, two canal/irrigation systems, and the Lewis and Clark Trail.

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[1] L_{dn} is the A-weighted equivalent sound level for a 24-hour period with 10 decibels added to nighttime sounds to adjust for increased sensitivity to noise at night.

[2] The A-weighted scale adjusts for the sensitivity of the human ear to different sound frequencies.

None of the prehistoric sites located within the two-mile-wide file search corridor are listed as eligible for NRHP status. Many of the prehistoric sites were left unevaluated with regard to NRHP status pending Native American Consultation.

Results of Field Investigations

Cultural resource field surveys were conducted from June 2008 through August 2008, and currently are ongoing. The survey corridor measured 300 feet and was generally centered on the pipeline corridor. During the surveys, SWCA located 106 sites within the survey corridor (Appendix G, Berg et al 2008a). Of these, 64 sites are prehistoric, 36 sites are historic, four sites are of unknown age, and two are multi-component sites containing both prehistoric and historic components.

The recorded sites included eight cairns, 14 stone concentrations with other artifacts, and 22 stone circles, 14 of which were associated with other artifacts. Artifact scatter was located at 24 prehistoric sites and 16 historic sites, primarily at isolated locations. Two roads, five railroads, two railroad beds, and six historic canals were located within the survey corridor. Three farmsteads and four historic structures were identified, as well as one gravesite. Finally, one general historic site was located within the survey corridor.

Of the sites identified in the survey corridor, 52 were recommended as eligible or potentially eligible for the NRHP. Sites recommended as eligible include five historic canals, one farmstead, five railroads and one railroad bed. Sites recommended as potentially eligible include eight cairns, nine stone concentrations, 22 stone circles, and one farmstead. Forty-eight sites are recommended as ineligible. These include one grave site, one road, one historic canal, 34 isolated historic or prehistoric sites, four historic or prehistoric sites, three isolated stone concentrations, three historic structures, and one stone concentration.. The remaining six sites are unevaluated Evaluative testing of these sites is necessary for final recommendations.

<u>Steele City Segment - South Dakota</u>

Results of Record Search

SWCA conducted a Class I files/records search, from May 7 through May 8, 2008, at the South Dakota State Archaeological Research Center (SARC). These file searches yielded 49 previously recorded sites and 15 structures within the two-mile-wide file search corridor; only one site is located within the survey corridor. Results of this search are included in Appendix G (Berg et al. 2008b). Descriptions of the sites follow:

- 10 historic sites: two foundations, two depressions, two farmsteads, one artifact scatter, one non-farm ruin with associated artifact scatter, one school foundation, and one monument.
- 15 historic structures: six bridges, seven barns, one school house and one ranch.
- 33 prehistoric sites: 23 artifact scatters, one burial area, three occupation sites (two of which are associated with quarries), two stone circles, and four isolated finds.
- Six sites of undetermined age/site type: two cairn sites, one rock art site, and three faunal sites.

None of the historic sites located within the two-mile-wide file search corridor are listed as eligible for NRHP status. Of the historic structures, three barns and a ranch have been determined eligible for the NRHP.

Of the prehistoric sites, one artifact scatter located within the file search corridor is listed as eligible for NRHP status. Many of the prehistoric sites were left unevaluated with regard to NRHP status pending Native American Consultation.

Only one site, a prehistoric stone circle site, is located within the two-mile-wide file search corridor (based on previously recorded location information) and is located within the 300-foot survey corridor. This site is listed as unevaluated with regard to NRHP status pending Native American Consultation..

Results of Field Investigations

Cultural resource field surveys for the Project began in South Dakota on June 25, 2008, and currently are ongoing. The survey corridor measured 300 feet and was generally centered on the pipeline corridor. During the surveys, SWCA located 23 sites within the survey corridor (Appendix G, Berg et al 2008b). Of these, four sites are prehistoric and 19 sites are historic.

Three of the four prehistoric sites are recommended as eligible for NHRP and one is recommended as ineligible. Of the 19 historic sites, one farmstead is recommended as potentially eligible and one farmstead is recommended as eligible for the NRHP. Sixteen historic sites, including 14 historic scatter sites, one windmill, and one railroad bed are recommended as ineligible. The remaining site is a grave stone and is recommended as ineligible; however, the site would be treated as a protected resource.

Due to the increased likelihood of buried cultural material in the subsurface strata, the South Dakota SHPO has recommended that a qualified archaeologist be present during construction in predetermined locations as a trench monitor in the event of any subsurface discovery.

Steele City Segment - Nebraska

Results of Record Search: Cultural Resources

In April 2008, American Resources Group (ARG) conducted a literature and site files search through the Nebraska SHPO for an area covering two miles to either side of the proposed pipeline centerline. Fifty-seven previous cultural resources surveys were conducted in the four-mile-wide file search corridor. Six of these surveys cross or are adjacent to the proposed pipeline corridor.

As a result of the literature and files search, 50 previously documented archaeological sites were identified within the four-mile-wide file search corridor. Results of this search are included in Appendix G (Titus et al. 2008). These include two sites within 300 feet of the proposed pipeline centerline, five within 0.25 mile, and 43 sites within two miles. Descriptions of these sites follow:

- 24 prehistoric sites;
- 22 historic sites;
- One site with both prehistoric and historic components; and
- Three sites of unknown age.

The two sites that lie within 300 feet of the proposed pipeline centerline also were recorded during the cultural resources survey for the Keystone Pipeline Project. One of these sites is a prehistoric limited activity site and the other is a twentieth-century historic windmill; these sites were evaluated as ineligible for the NRHP.

There are five sites located within 0.25 mile of the proposed pipeline centerline: Horse Creek, Hordville, Kasak Cemetary, and two historic European-American sites. The Horse Creek site includes a historic Pawnee earth lodge village that was occupied by at least two Pawnee bands between 1810 and 1842. The site was partially excavated in the 1930s and 1940s, unearthing storage pits, houses, middens, and what may have been a horse corral. Earthen mounds or linear features were reported in 1950 along the east edge of the site. This site is listed on the NHRP.

The Hordville site was first recorded by Walter Wedel in 1938 as a historic Pawnee site that had been described previously in Nebraska history publications from 1920 and 1933. The 1920 article describes B.E. Bengsten's first visit to the village site in 1877. Along the bluff overlooking the Platte River valley to the southeast and southwest of the site, he observed human remains on the ground surface. During his second visit to the site in 1919, he documented the construction of two farmsteads on the bluffs in the general vicinity of the human remains. The 1933 publication contains a more general description of the village site at that time, as well as a hand-drawn map illustrating the location of earth lodge houses and burials. An area described as the "main Indian burying grounds" is located southeast of the village, and appears to be adjacent to the proposed pipeline corridor.

Kasak Cemetery was recorded in 2005 as an historic European-American cemetery. The cemetery is marked by a sign and several surface irregularities assumed to correspond with the location of graves. There are no existing headstones.

The final two sites located within 0.25 mile of the centerline are historic European-American sites. One is located in the uplands overlooking the Loup River floodplain and has been determined by SHPO to be ineligible to the NRHP. The other was recorded in 1982 during a survey for the Trailblazer Pipeline as a historic artifact scatter and was not evaluated for NRHP eligibility.

None of the remaining 43 sites have been evaluated as eligible to list on the NRHP.

Results of Record Search: Historic Architectural Properties

A total of 226 architectural properties were recorded within the four-mile-wide file search corridor; 36 have been evaluated as eligible or potentially eligible for listing on the NRHP (Appendix G, Titus et al. 2008). The remaining properties have been classified as contributing, non-contributing, or unknown (not evaluated).

Of the 45 architectural properties within 0.25 mile of the proposed pipeline centerline, five are eligible or potentially eligible for the NRHP, one of which is within approximately 500 feet of the proposed centerline. Ten of the 45 architectural properties are less than 0.25 mile of the proposed pipeline centerline. These ten properties include six farmsteads, two schoolhouses, one house, and one cemetery.

Results of Record Search: Potential Historic Sites

A review of historic maps, General Land Office (GLO) plats, and various other historic sources indicate the presence of a minimum of 111 potential historic sites within or adjacent to the two-mile-wide historic structure file search corridor. These sources identify a variety of potential site types, including farmsteads, rural households, soddies, schools, cemeteries, roads, railroads, canals, Indian burial grounds, and post offices. Cultural boundaries identified, but not included in the above total, include Indian reservations and villages. .

A total of 74 houses or farmsteads, two sod houses, eight schools, one post office, two historic cemeteries, 11 rail lines, 10 historic roads, one historic Indian burial ground, and one canal were identified along the proposed pipeline corridor during a review of historic maps and atlases, GLO plats, and county histories. In addition, the proposed pipeline corridor crosses the former Pawnee Reservation and locations of Pawnee villages and burial sites.

Of particular importance are a number of significant historic trails that spanned eastern and north-central Nebraska, many of which played major roles in facilitating western expansion in the late nineteenth century. Several roads or trails were identified during a review of county histories and GLO plats dating from the 1850s to 1880s, including a wagon trail, the Gordon Trail, Fort Kearney and Mormon Trail, Fort Kearney and Plattesmouth Road (Oregon Trail), Fort Kearney and Nebraska City Road, and the Oregon Trail and Fort Leavenworth and Laramie Road.

Results of Field Investigations

Cultural resource inventories were conducted by ARG between May and July 2008. . The survey corridor measured 300 feet and was generally centered on the pipeline corridor. As a result of surveys, 61 sites were identified within the survey corridor. Of the 61 sites, 55 are historic and six are prehistoric (Appendix G, Titus et al. 2008).

The six prehistoric sites consist of three isolated finds recommended as ineligible to the NHRP, two artifact scatters that are recommended as potentially eligible, and one possible Pawnee burial ground, which has been potentially relocated and would be treated as a protected resource. The lead federal agency would be responsible for facilitating consultation with the appropriate Pawnee Nation tribal chairman in reference to an avoidance strategy. This site consists of an area approximately 4,472 square meters, which has been noted in several historic plat maps. Two shovel tests were conducted on site and yielded no significant cultural or burial material remains.

The 55 historic sites include six railroads, two railroad beds, four roads, one historic canal, one modern canal, 18 farmsteads, 19 historic structures containing windmills and livestock watering areas, three artifact scatters, and one farmstead with associated debris and a railroad bed. With the exception of one farmstead, all of the historic sites are recommended as ineligible for the NRHP.

Gulf Coast Segment - Oklahoma

Results of Record Search

ENSR completed files/records searches in November 2007 at the Oklahoma SHPO and the Oklahoma Archeological Survey (OAS). SWCA Environmental Consultants (SWCA) completed an additional files/records search in May 2008 at the OAS office.

These searches yielded 103 previously recorded cultural resources within a 2-mile-wide Study Area centered on the proposed Project centerline. Sites located through these record searches include:

- Nine historic standing structures: five bridges and four churches, including at least one church historically associated with Native Americans. The four churches are listed in the Oklahoma Landmarks Inventory (OLI) and two of the five bridges have been determined eligible for the NRHP.
- 27 cemeteries: all are protected under state law. All but four of these are located more than 1,000 feet from the 300-foot-wide Survey Area. The four cemeteries less than 1,000 feet from the Survey area are two unnamed cemeteries, designated by the SHPO as CE 4 and CE 5 on the uplands north of the North Canadian River in Okfuskee County, an unnamed cemetery (designated CE 26 by the SHPO) in Coal County, and the High Hill Cemetery north of Clear Boggy Creek in Atoka County (undesignated).
- 76 archaeological sites: two of these are within the Survey Area and four lie immediately adjacent to the Survey Area (Table 3.9-1). The remaining 70 archaeological sites consist of 48 prehistoric sites, 15 historic sites, and 7 sites that are undefined, lacking the basic data on temporal affiliation. In terms of site distributions, the counties with the highest concentrations of sites are Bryan, Atoka, and Hughes, accounting for 53 of the 70 recorded sites (75%) in the Study Area. The remaining 17 sites are equitably distributed throughout the other six counties.
    - The 40 prehistoric sites are primarily open habitations, and the remaining eight prehistoric sites consist of a workshop, a specialized activity area, and six are undefined site types.
    - The historic sites include nine farmsteads, one historic trash dump, a structure, and two artifact scatters.

Table 3.9-1 Archaeological Sites in or Immediately Adjacent to the 300-Foot-Wide Survey Area for the Gulf Coast Segment

Site Number	Site Name or Description	Relation to Survey Area	Status
34AT56	Historic or protohistoric Native American campsite	Adjacent	Unevaluated for the NRHP.
34AT661	Early 20th century Euro-American farmstead	Inside	Recommended NRHP-ineligible.
34CO53	Prehistoric lithic scatter	Adjacent	Unevaluated for the NRHP.
34HU21	Prehistoric lithic procurement site & workshop	Inside	Unevaluated for the NRHP.
34HU94	Historic farmstead (ethnic affiliation & age unknown)	Adjacent	Recommended "probably NRHP-ineligible," but not formally evaluated for the NRHP.
34HU114	Mid-19th century-to-modern Butner Cemetery (Native & Euro-American)[1]	Adjacent	Recommended for OLI designation and protected under state law.

[1] Because of the historic Native American use of this cemetery, it was assigned an official trinomial by the OAS and is counted as an archaeological site for the purposes of this study.

In addition to the already documented cultural resources within the 2-mile-wide Study Area, ENSR and SWCA identified 128 "site leads." For the purposes of this study, site leads are defined as areas with a high-probability for cultural resources. ENSR and SWCA identified one site lead through a report of the Calf Creek Site found by amateurs and not yet verified by a professional archaeologist (therefore no official trinomial has been assigned by the OAS). More commonly, ENSR and SWCA identified the other 127 site leads by symbols for structures depicted in particular areas on the historic Government Land Office (GLO) maps of 1897-1899. All site leads are houses, except a store, post office, church, cotton gin, school, and a coal pit are also included among the structures on GLO maps.

ENSR also identified several landscape-scale resources that will be crossed by the proposed pipeline. These large-scale areas are oil and gas fields as well as several mines, all of which apparently have not been formally evaluated for their NRHP-eligibility as cultural landscapes or historic districts. These resources are summarized in Table 3.9-2.

Table 3.9-2 Landscape-Scale Resources to be Crossed by the Proposed Project for the Gulf Coast Segment

Name	County	Date Opened	Status
St. Louis Galveston Coal & Mining Company No. 2 & No. 3 Mines	Coal	1870s-1880s?	Unevaluated for the NRHP.
Phillips Mine	Coal	1870s-1880s?	Unevaluated for the NRHP.
Hazilton Mine	Coal	1870s-1880s?	Unevaluated for the NRHP.
Hickory Hill Strip Mine	Atoka	unknown	Unevaluated for the NRHP.
Allen Oil & Gas Field	Pontotoc	1913	Unevaluated for the NRHP.
Holdenville Oil & Gas Field	Hughes	1916	Unevaluated for the NRHP.
Wewoka Oil & Gas Field	Seminole	1912	Unevaluated for the NRHP.
Rood-Bethel (Holm-Jarris) Oil & Gas Field	Seminole	1924	Unevaluated for the NRHP.
Cromwell Oil & Gas Field	Seminole	1923	Unevaluated for the NRHP.
Paden Oil & Gas Field	Okfuskee	1914	Unevaluated for the NRHP.
Stroud Oil & Gas Field	Creek & Lincoln	1923	Unevaluated for the NRHP.
Kendrick (Skelly-Ford) Oil & Gas Field	Lincoln	1925	Unevaluated for the NRHP.
Agra (Wildhorse) Oil & Gas Field	Lincoln	1919	Unevaluated for the NRHP.

Results of Field Investigations

Cultural resource field surveys were conducted from May 2008 through July 2008, and are ongoing. These surveys consisted of pedestrian reconnaissance, shovel testing, and backhoe-trenching. As a result of these surveys, SWCA surveyed approximately 124.1 miles out of a total of 156.3 miles required for survey (79.4% complete). Table 3.9-3 summarizes the survey progress on a county-by-county basis. Some of the landowners along the 156.3-mile-long Survey Area refused survey permission, whereas responses from other landowners had not been received while SWCA crews were in the field.

Table 3.9-3 Cultural Resources Survey Progress by County for the Gulf Coast Segment

County	Required for Survey[1] (miles)	Completed Survey (miles)	% Complete
Atoka	19.7	13.5	68.5
Bryan	22.6	18.5	81.9
Coal	26.0	21.5	82.7
Creek	5.1	4.9	95.0
Hughes	27.4	17.4	63.5
Lincoln	18.3	16.7	91.3
Okfuskee[2]	17.0	12.8	75.3
Payne	0.2	0	0
Seminole	20.0	18.8	94
Total	**156.3**	**124.1**	**79.5**

[1] The OAS and the Oklahoma SHPO required 100% survey of the 300-ft-wide Survey Area. However, different survey standards were used in high-probability areas vs. low-probability areas as per the ENSR/SWCA survey protocols agreed upon by the OAS & SHPO.
[2] Included 1.48 miles required & surveyed from previous alignment (062008)

In addition to surface reconnaissance and shovel testing, SWCA crews also completed 44 backhoe trenches to identify deeply buried cultural resources, if present, at eight (8) stream crossings (Table 3.9-4).

Table 3.9-4 Stream Crossings Tested by Backhoe Trenching for Deeply Buried Cultural Resources for the Gulf Coast Segment

Stream Crossing	County	Milepost	Number of Trenches	Result
Little River	Hughes	70.0-70.33	9	3 positive trenches
Wewoka Creek	Seminole	58.4-58.9	6	All negative
Sand Creek	Seminole	43.45-43.9	4	All negative
Deep Fork Creek	Creek & Okfuskee	22.92-23.75	7	All negative
Euchee Creek	Lincoln	4.1-4.5	5	All negative
North Canadian River	Seminole	39.05-39.24	3	All negative
	Okfuskee	38.69-39.0	3	All negative
Cowpen Creek	Atoka	130.2-130.45	3	All negative
Red River	Bryan	154.4-154.55	4	All negative

SWCA recorded 45 cultural resource sites in the Survey Area. Of these sites, over half are Native American [likely all prehistoric, archaeological sites or isolated finds (n=23)], 12 are historic archaeological sites or isolated finds, three are multi-component archaeological sites, four are historic standing structures, two are cultural landscapes, and one is a cemetery. Ten of the 45 recorded resources are located in Hughes County, eight are in Coal and Atoka counties each, seven are in Lincoln and Okfuskee counties each, four are in Smith County, and one is in Bryan County.

The majority of the newly discovered or revisited Native American sites are lithic scatters (n=17) or isolated lithic finds (n=5). One Native American archaeological site is an artifact scatter, likely prehistoric. The 10 historic archaeological sites and isolated finds (n=2) all appear to be related to past domestic activities – individual ceramic or glass artifacts, a historic dump, and a few locations with remnants of former structures.

The three multi-component sites possess evidence of prehistoric Native American and Contact or Post-Contact period artifacts. Half of the historic standing structures documented during SWCA's survey are residential (n=2); the other two are agricultural buildings, including a barn that may have been built ca. 1940s.

The two cultural landscapes recorded during SWCA's survey for the proposed Keystone XL Project consist of a segment of the NRHP-listed historic highway known as "Route 66" and the historic townsite of Key West. The proposed pipeline will cross both these cultural landscapes in Lincoln County.

The cemetery documented by SWCA is known locally as the "Baker Cemetery." Headstones in the cemetery indicate burials there from approximately 1900 to 1907. A local informant told SWCA that the cemetery was used by Native Americans.

Of the 45 recorded cultural resources to be crossed by the proposed Project in Oklahoma, SWCA will recommend 37 as ineligible for nomination to the NRHP. One of the 45 resources is a segment of historic Route 66, which is already listed in the NRHP. Two of the 45 resources will be recommended as eligible for the NRHP and five will be recommended as potentially eligible for the NRHP.

<u>Gulf Coast Segment - Texas</u>

Results of Records Search

ENSR completed files/records searches in November 2008 at the Texas Archeological Research Laboratory (TARL) and in the online atlases for historic sites and archaeological sites maintained by the Texas Historical Commission (THC). HRA Gray & Pape (HRAGP) completed a supplementary records search of the Atlas as well as an additional records search at the TARL (both in May 2008). SWCA completed an additional files/records search in June 2008 at the TARL for a major reroute proposed in the Lufkin area; this is known for the proposed Project as the "Lufkin Reroute."

These searches yielded 395 previously recorded cultural resources within a 2-mile-wide Study Area centered on the proposed Project centerline, including the Lufkin Reroute. No neighborhood surveys, historic county courthouses, museums, military sites, sawmills, or NRHP properties are recorded in the THC's Historic Sites Atlas for the Project's Study Area. However, sites identified through the record searches include:

- Fifteen (15) historical markers: Table 3.9-5 illustrates that some designate former ferry locations (in Angelina and Upshur counties); some are markers in communities associated with individual pioneers, such as Leroy Nelson DeWitt (in Mount Joy) and Thomas Wilson Stegall (in Lake Creek), or people significant in Texas history, such as John William Wilson (also in Lake Creek), Capt. F. Marion Hastings (in Mount Vernon), and John R. Clute (in Douglass); one (1) marker is for a school; and two (2) markers are for former townsites – the Starrville Community and Chalybeate Springs. The other five (5) markers designate churches with or without cemeteries in Franklin County (40%),

Polk County (20%), Rusk County (20%), and Wood County (20%). The Clark's Ferry Cemetery in Angelina County is included in the marker for the Clark's Ferry (cited above) and in the cemetery count (described below). No historical markers lie inside the 300-foot-wide Survey Area; however, markers for the Starrville Community (No. 7760) and Walters' Bluff Ferry (No. 11353) are immediately adjacent to the Survey Area. The other 13 historical markers are distributed throughout the 2-mile-wide Study Area.

- Fifty-one (51) cemeteries: As shown in Table 3.9-6, almost 65% of the previously recorded cemeteries are in Angelina, Delta, Lamar, Nacogdoches, and Wood counties. One of these cemeteries, Boatwright in Rusk County, also has been assigned an official trinomial by the THC (41RK90) and as such, is counted among the archaeological sties as well (described below). The Smith Cemetery (WD-C107) and Cottonwood Cemetery (LR-C049) are the only two inside the 300-foot-wide Survey Area. Four additional cemeteries are immediately adjacent to the Survey Area (Dubose-Fairchild, AG-C042; Sulphur Bluff, HP-C022; unnamed, JF-C007; and Redland, NA-C012), and the other 45 recorded cemeteries are distributed throughout the 2-mile-wide Study Area.

- 295 archaeological sites: The majority of the recorded archaeological sites in the Study Area are artifact scatters (n=109) and lithic scatters (n=86), for a combined total accounting for 66.1% of the previously recorded archaeological sites. Over 57% of sites with structural remnants (n=35) also contain artifact scatters. Multi-component or suspected to be multi-component sites, mostly scatters or middens sometimes with structural remnants or historic standing structures account for 9.5% of the recorded archaeological sites (n=28). Seventeen (17) of the recorded archaeological sites are cemeteries or burials, including 41RK90 (see above), and seven (7) are earthworks. It should be noted that one of the cemeteries or burials also contains an artifact scatter and another is also associated with an artifact scatter and structural remnants. Four (4) of the recorded archaeological sites are isolated finds and another four (4) are really site leads since they are informant reports (n=2) or the site form is missing from TARL and THC files (n=2). Information about site type and cultural affiliation are missing for five (5) of the recorded sites. Over 45% of the sites are Native American, prehistoric or likely prehistoric, whereas approximately 38% of the sites are Euro- and/or Afro-American, historic or likely historic. Of the previously recorded archaeological sites in the Study Area, six (6) are recorded within the 300-foot-wide Survey Area, and 15 lie immediately adjacent to the Survey Area (Table 3.9-7).

- Thirty-four (34) historic standing structures given official trinomial designations by the TARL: located in the 2-mile-wide Study Area in Cherokee, Jefferson, Liberty, Nacogdoches, Rusk, Smith, and Wood counties, these resources may or may not include archaeological components. For instance, 41WD167 is a historic road bed/bridge abutment. 41SM58, 41SM64, 41SM66, 41SM68, 41SM69, 41SM72, 41SM132, and 41SM135 are historic houses, barns and/or outbuildings, some dating as early as 1830 and others as late as post-1930. Likewise, 41CE180, 41CE182, 41CE183, 41CE221, 41CE222, 41CE249, 41CE250, 41CE251, 41CE253, 41CE254, 41CE257, 41CE272, 41RK91, 41RK93, and 41RK98 are historic home- or farmsteads with standing structures or other architectural features, such as wells. Site 41RK97 is noteworthy, because it is recorded as a historic pumping station with storage tanks and two sheds, a pump platform, records/tools house, generator house, and water tank in addition to structural remnants (house foundations) and an artifact scatter. 41NA30 includes the remains of a historic log cabin in addition to a well and an artifact scatter. 41JF66 is the early 20th century Tyrrell Tenant Farmstead, whereas 41LB94 is the historic Mary Ellon Harris Home, including outbuildings.

Table 3.9-5 Distribution of Recorded Historical Markers in the 2-Mile-Wide Study Area by County for the Gulf Coast Segment

County	Marker Count (#)	Marker Subject
Angelina	2	Clark's Ferry & Clark's Ferry Cemetery; Central Consolidated School

Table 3.9-5 Distribution of Recorded Historical Markers in the 2-Mile-Wide Study Area by County for the Gulf Coast Segment

County	Marker Count (#)	Marker Subject
Cherokee	0	n/a
Delta	3	Leroy Nelson DeWitt; Thomas Wilson Stegall; John William Wilson
Fannin	0	n/a
Franklin	3	Cypress Church & Cemetery; Capt. F. Marion Hastings; Pleasant Hill Methodist Church & Cemetery
Hardin	0	n/a
Hopkins	0	n/a
Jefferson	0	n/a
Lamar	0	n/a
Liberty	0	n/a
Nacogdoches	1	John R. Clute
Polk	1	Damascus Missionary Baptist Church
Rusk	1	Pleasant Grove Methodist Episcopal Church South Cemetery
Smith	1	Starrville Community
Upshur	1	Walters' Bluff Ferry
Wood	2	Chalybeate Springs; Smyrna Baptist Church
Total	**15**	

Table 3.9-6 Distribution of Recorded Cemeteries in the 2-Mile-Wide Study Area by County for the Gulf Coast Segment

County	Site Count (#)	Frequency (%)
Angelina	11	21.6
Cherokee	0	0
Delta	5	9.8
Fannin	0	0
Franklin	3	5.9
Hardin	1	2.0
Hopkins	2	3.9
Jefferson	2	3.9
Lamar	5	9.8
Liberty	0	0
Nacogdoches	5	9.8

Table 3.9-6 Distribution of Recorded Cemeteries in the 2-Mile-Wide Study Area by County for the Gulf Coast Segment

County	Site Count (#)	Frequency (%)
Polk	4	7.8
Rusk	3	5.9
Smith	2	3.9
Upshur	1	2.0
Wood	7	13.7
Total	**51**	**100**

Table 3.9-7 Archaeological Sites in or Immediately Adjacent to the 300-Foot-Wide Survey Area for the Gulf Coast Segment

Site Number	Site Name or Description	Relation to Survey Area	Status
41CE223	Unknown prehistoric lithic scatter	Adjacent	SAL[1] & NRHP eligibility unknown
41CE251	Historic house, barn, artifact scatter	Adjacent	SAL & NRHP eligibility unknown
41CE252	Historic artifact scatter	Adjacent	SAL & NRHP eligibility unknown
41CE303	Historic artifact scatter & well site	Adjacent	SAL & NRHP ineligible
41FK63	Unknown prehistoric lithic scatter	Adjacent	SAL & NRHP eligibility unknown
41FK104	Unknown prehistoric lithic scatter (campsite?)	Adjacent	SAL & NRHP eligibility unknown
41FN40	Historic artifact scatter	Adjacent	SAL & NRHP ineligible
41FN41	Multicomponent artifact scatter (historic & unknown prehistoric)	Adjacent	SAL & NRHP ineligible
41FN42	Historic isolate/artifact scatter	Adjacent	SAL & NRHP ineligible
41FN82	Unknown prehistoric artifact scatter	Inside	SAL & NRHP eligibility unknown
41FN83	Historic artifact scatter	Adjacent	SAL & NRHP eligibility unknown
41FN84	Historic artifact scatter	Adjacent	SAL & NRHP eligibility unknown
41LR133	Historic artifact scatter	Inside	SAL & NRHP ineligible
41LR311	Multicomponent artifact scatter (historic & unknown prehistoric)	Adjacent	NRHP-ineligible; SAL eligibility unknown
41LR312	Multicomponent artifact scatter (historic & unknown prehistoric)	Adjacent	NRHP-ineligible; SAL eligibility unknown
41RK97	Historic artifact scatter & outlbuildings (former oil camp)	Inside	SAL & NRHP eligibility unknown
41SM282	Multicomponent – historic homesite; prehistoric/Lower Mississippi Valley artifact scatter	Inside	SAL & NRHP eligibility unknown

Table 3.9-7 Archaeological Sites in or Immediately Adjacent to the 300-Foot-Wide Survey Area for the Gulf Coast Segment

Site Number	Site Name or Description	Relation to Survey Area	Status
41SM287	Prehistoric artifact scatter, possibly including Early Caddoan	Inside	SAL & NRHP eligibility unknown
41UR84	Prehistoric lithic scatter	Adjacent	SAL & NRHP ineligible
41UR85	Paron Church/Smith Cemetery	Inside	SAL & NRHP ineligible, but cemetery is protected under state law
41WD165	Historic artifact scatter	Adjacent	SAL & NRHP ineligible
[1] SAL is the abbreviation for State Archeological Landmark.			

As shown in Table 3.9-8 approximately 20% of the previously recorded archaeological sites are in Cherokee County. Almost 55% of the sites are in Nacogdoches, Smith, Upshur, and Wood counties combined. Angelina, Franklin, and Rusk counties each have 4-5% of the previously recorded sites. Counties with the least sites are Fannin, Lamar, Polk, Liberty, Jefferson and Hopkins (tied), Delta, and Hardin (in descending order).

Table 3.9-8 Distribution of Recorded Archaeological Sites in the 2-Mile-Wide Study Area by County for the Gulf Coast Segment

County	Site Count (#)	Frequency (%)
Angelina	13	4.4
Cherokee	60	20.3
Delta	1	0.3
Fannin	10	3.4
Franklin	14	4.7
Hardin	0	0
Hopkins	2	0.7
Jefferson	2	0.7
Lamar	8	2.7
Liberty	4	1.4
Nacogdoches	42	14.2
Polk	6	2.0
Rusk	13	4.4
Smith	42	14.2
Upshur	41	13.9
Wood	37	12.5
Total	**295**	**100**

Results of Field Investigations

Cultural resource field surveys were conducted from May 2008 through July 2008, and are ongoing. These surveys consisted of pedestrian reconnaissance and shovel testing of high-probability areas (HPAs) in addition to backhoe trenching at major stream crossings. As a result of these surveys, HRAGP surveyed approximately 70 miles and SWCA surveyed approximately 20 miles out of a total of approximately 156 miles of HPAs required for survey (57.7% complete). Table 3.9-9 summarizes the survey progress on a county-by-county basis. Some of the landowners with tracts containing HPAs ("Required for Survey") refused survey permission, whereas responses from other landowners had not been received while HRAGP and SWCA crews were in the field. In addition to surface reconnaissance and shovel testing, HRAGP crews also completed 44 backhoe trenches to identify deeply buried cultural resources, if present, at four (4) stream crossings (Table 3.9-10).

Table 3.9-9 Cultural Resources Survey Progress by County for the Gulf Coast Segment

County	Required for Survey (miles)	Completed Survey (miles)	% Complete
Angelina[1]	12.6	0.7	5.6
Cherokee[1]	8.7	5.5	63.2
Delta[2]	7.1	6.1	85.9
Fannin	0.9	1.5	166.7
Franklin	6.7	5.6	83.6
Hardin	3.8	0.9	23.7
Hopkins	13.0	10.3	79.2
Jefferson	6.9	3.5	50.7
Lamar[2]	17.1	6.8	39.8
Liberty	8.3	6.2	74.7
Nacogdoches[3]	8.6	8.7	101.2
Polk	23.9	10.7	44.8
Rusk	7.5	5.7	76.0
Smith	16.4	9.1	55.5
Upshur[3]	1.4	1.8	128.6
Wood	13.2	7.7	58.3
Total	**156.1**	**90.8**	

[1] Includes surveys in Survey Area as originally proposed in addition to Lufkin Reroute.

[2] Includes 0.5 miles (Delta) and 0.37 miles (Lamar) required & complete in Survey Area as originally proposed and in Survey Area as redesigned by 062008.

[3] Includes (Nacogdoches) and (Upshur)

Table 3.9-10 Stream Crossings Tested by Backhoe Trenching for Deeply Buried Cultural Resources for the Gulf Coast Segment

Stream Crossing	County	Milepost	Number of Trenches	Result
Sanders Creek	Lamar	168.9	1	South side only (north side inaccessible). Negative.
Little Cypress Creek	Franklin	224.7	1	North side only (north side inaccessible). Negative.
Gum Branch	Franklin	228.2	2	West side only. Negative.
Angel Branch	Franklin	229.7	1	North side only (north side inaccessible). Negative.

HRAGP recorded a total of 33 cultural resource sites, and SWCA recorded five (5) cultural resource sites for a total of 38 in the Survey Area. Of the 33 sites visited by HRAGP, three (3) had been recorded previously - 41SM287, 41RK97, and 41FK104. One of the five (5) sites visited by SWCA had been recorded previously – 41LB73.

Of the 38 cultural resources visited or revisited during HRAGP and SWCA field work, approximately 42% are Native American, likely all prehistoric, archaeological sites or isolated finds (n=16), seven (7) historic archaeological sites or isolated finds, one (1) historic feature and one (1) structural remnant, six (6) multi-component archaeological sites, five (5) historic standing structures, one (1) likely cemetery, and one (1) unknown find (site type and cultural/temporal affiliation). Nine (9) of the 38 recorded resources are located in Rusk County, five (5) are in Hopkins County, four (4) are in Cherokee, Polk, and Smith counties each, three (3) are in Franklin and Nacogdoches counties each, two (2) in Wood County, and one in Delta, Fannin, Liberty, and Upshur counties each.

The majority of the newly discovered or revisited Native American sites are lithic scatters (n=2) or isolated lithic finds (n=9). Five (5) Native American archaeological sites are artifact scatters, likely prehistoric. The six (6) historic archaeological sites or isolated finds all appear to be related to past domestic or agricultural activities, including a few locations with remnants of former structures.

The six (6) multi-component sites possess evidence of prehistoric Native American and Contact or Post-Contact period artifacts. Two (2) of the historic standing structures documented during the surveys are associated with religious functions (church and possibly associated outhouse), two (2) are agricultural buildings, and one (1) is a former petroleum pumping station.

Of the 38 recorded cultural resources to be crossed by the proposed Project in Texas, SWCA will recommend 18 as ineligible for nomination to the NRHP. None of the 38 resources are already listed in the NRHP. Nine (9) of the 38 resources will be recommended as potentially eligible for the NRHP. The NRHP-eligibility of the remaining 11 resources is presently unknown, pending further inquiry.

Houston Lateral

Results of Records Search

ENSR completed files/records searches in April 2008 at the TARL and in the online Atlas of archaeological sites maintained by the THC. SWCA completed a supplementary records search of the Atlas as well as an additional records search at the TARL (both in June 2008). No known cultural resources are present within the 2-mile-wide Study Area centered on the proposed Houston Lateral centerline.

Results of Field Investigations

Cultural resource field surveys were conducted from May 2008 through July 2008, and are ongoing. These surveys consisted of pedestrian reconnaissance and shovel testing of high-probability areas (HPAs). As a result of these surveys, SWCA surveyed less than four (4) miles out of a total of approximately 12.7 miles of HPAs required for survey (25.2% complete). Table 3.9-11 summarizes the survey progress on a county-by-county basis. Some of the landowners with tracts containing HPAs ("Required for Survey") refused survey permission, whereas responses from other landowners had not been received while SWCA crews was in the field.

Table 3.9-11 Cultural Resources Survey Progress by County for the Houston Lateral

County	Required for Survey (miles)	Completed Survey (miles)	% Complete
Chambers	0.3	0	0
Harris	3.2	0	0
Liberty	9.1	3.2	35.2
Total	**12.7**	**3.2**	**25.2**

No cultural resources were encountered during SWCA's survey in the Survey Area for the Houston Lateral. Two stream crossings – San Jacinto and Trinity rivers – are slated for backhoe trenching in late 2008 or early 2009.

3.10 Native American Consultation

Federal statutes and implementing regulations require consultation with Native American tribes concerning the identification of cultural values, religious beliefs, and traditional practices of Native American people that may be affected by federally approved actions. These federal statutes include, but are not limited to:

Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended, requires all federal agencies to avoid or mitigate adverse effects of their actions on historic properties and provide the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on those actions and the manner in which federal agencies are taking historic properties into account in their decisions. The ACHP's implementing regulations, specifically 36 CFR Part 800.2(c)(2)(ii), ensure that Native American tribes have a reasonable opportunity to identify their concerns about historic properties, advise on the identification and evaluation of historic properties, including those of traditional religious and cultural importance, articulate their views on the undertaking's effects on such properties, and participate in the resolution of adverse effects, regardless of the location of the historic property.

Executive Order 13007 requires federal agencies to accommodate access to and ceremonial use of Native American sacred sites by Indian religious practitioners and to avoid adversely affecting the physical integrity of such sacred sites. It also requires agencies to develop procedures for reasonable notification of proposed actions or land management policies that may restrict access to or ceremonial use of, or adversely affect, sacred sites.

American Indian Religious Freedom Act or (AIRFA 1978) established federal policy of protecting and preserving the inherent right of individual Native Americans to believe, express, and exercise their traditional religions. The legislation established that laws passed for other purposes were not meant to restrict the rights of Native Americans.

Native American Graves Protection and Repatriation Act or (NAGPRA 1990) established a means for Native Americans, including collective groups or bands, to request the return of human remains and other culturally affiliated items held by federal agencies or federally assisted museums or institutions. NAGPRA also contains provisions regarding the intentional excavation and removal of, inadvertent discovery of, and illegal trafficking in Native American human remains and sensitive cultural items.

Consultation with federally recognized Native American tribes must occur on a government-to-government basis [36 CFR Part 800.2(c)(2)(ii)]; therefore, tribal consultation is the responsibility of the lead federal agency. Under 36 CFR Part 800.3(f)(2), it is the lead federal agency's duty to make a reasonable and good faith effort to identify any Native American tribes that might attach religious and cultural significance to historic properties in the Area of Potential Effects (APE) and invite them to be consulting parties. Some tribes have a Tribal Historic Preservation Officer (THPO) while others have a tribally designated individual or group of individuals responsible for consultation, such as elected tribal officials (e.g., the chief or council) or other respected community leaders, such as elders.

Places that may be of traditional cultural importance to Native American people include, but are not limited to, locations associated with the traditional beliefs concerning tribal origins, cultural history, or the nature of the world; locations where religious practitioners went or go to perform ceremonial activities based on traditional cultural rules or practice; ancestral habitation sites; trails; burial sites; and places from which plants, animals, minerals, and waters possessing healing powers or used for other subsistence purposes, may be taken. Additionally, some of these locations may be considered sacred to particular Native American individuals or tribes. It is the responsibility of all parties involved to take into account the effects the proposed Project may have on all localities.

If a resource has been identified as having importance in traditional cultural practices and the continuing cultural identity of a community, it may be considered a traditional cultural property (TCP). The term "traditional cultural property" first came into use within the federal legal framework for historic preservation and cultural resource management in an attempt to categorize historic properties containing traditional cultural significance. National Register Bulletin 38: *Guidelines for Evaluating and Documenting Traditional Cultural Properties* (Parker and King 1989) defines a TCP as "one that is eligible for inclusion in the NRHP because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community." To qualify for nomination to the NRHP, a TCP must be more than 50 years old, must be a place with definable boundaries, must retain integrity, and meet certain criteria as outlined in National Register Bulletin 15: *How to Apply the National Register Criteria for Evaluation* (NPS 1995).

3.10.1 Tribal Engagement

Keystone and affiliated organizations initiated Native American engagement by sending letters to the Native American tribes listed below. These tribes were identified as potentially falling within the consultation requirements of the above discussed statutes. The letters were sent to inform the various tribes of the proposed undertaking and to develop an interactive relationship with the tribes. Keystone made clear that this engagement did not represent government-to-government consultation, which is the purview of the lead federal agency. Tribes that were contacted as part of the initial undertaking are summarized in Table 3.10-1, along with their responses.

Table 3.10-1 Tribal Contact List

State	Tribe	Date of Contact	Status
Steele City Segment			
Montana	Blackfeet Nation	May 27, 2008	Written reply as of July 24, 2008. Consultation desired.

Table 3.10-1 Tribal Contact List

State	Tribe	Date of Contact	Status
	Fort Peck Tribes	May 27, 2008	Verbal reply as of July 24, 2008. Consultation desired.
	Northern Cheyenne Tribe	May 27, 2008	Written reply as of July 24, 2008. Consultation desired.
	Salish & Kootenai Tribes	May 27, 2008	No reply.
	Little Shell	May 27, 2008	No reply.
	Crow	May 27, 2008	No reply.
	Chippewa Cree	May 27, 2008	No reply.
North Dakota	Standing Rock	May 27, 2008	Written reply as of July 24, 2008. Consultation desired.
	Fort Berthold Tribe	May 27, 2008	Verbal reply as of July 24, 2008. Consultation desired.
	Turtle Mountain Band of Chippewa	May 27, 2008	No reply.
	Spirit Lake Nation	May 27, 2008	No reply.
	Mandan, Hidatsa, and Arikara Nations	May 27, 2008	No reply.
South Dakota	Sisseton-Wahpeton	May 27, 2008	Written reply as of July 24, 2008. Consultation desired.
	Yankton Sioux	May 27, 2008	No reply.
	Rosebud Sioux	May 27, 2008	No reply.
	Ogalala Sioux	May 27, 2008	No reply.
	Flandreau Santee Sioux	May 27, 2008	No reply.
	Crow Creek Sioux	May 27, 2008	No reply.
	Cheyenne River Tribe	May 27, 2008	Verbal reply as of July 24, 2008. Consultation desired.
	Lower Brule Tribe	May 27, 2008	Verbal reply as of July 24, 2008. Consultation desired.
Nebraska	Ponca Tribe	May 27, 2008	Verbal reply as of July 24, 2008. Consultation desired.
	Santee Sioux Tribe	May 27, 2008	Verbal reply as of July 24, 2008. Consultation desired.
	Omaha Tribe	May 27, 2008	Verbal reply as of July 24, 2008. Consultation desired.
	Winnebago	May 27, 2008	No reply.
	Sac & Fox of the Missouri	May 27, 2008	No reply.
Gulf Coast Segment			
Oklahoma	Absentee-Shawnee Tribe of Indians	May 27, 2008	No reply.

Table 3.10-1 Tribal Contact List

State	Tribe	Date of Contact	Status
	Alabama-Quassarte Tribal Town	May 27, 2008	No reply.
	Apache Tribe of Oklahoma	May 27, 2008	No reply.
	Caddo Nation of Oklahoma	May 27, 2008	No reply.
	Cherokee Nation of Oklahoma	May 27, 2008	No reply.
	Cheyenne-Arapaho Tribes of Oklahoma	May 27, 2008	No reply.
	Chickamauga Cherokee Nation MO/AR White River Band	May 27, 2008	No reply.
	Chickasaw Nation of Oklahoma	May 27, 2008	No reply.
	Choctaw Nation of Oklahoma	May 27, 2008	No reply.
	Citizen Potawatomi Nation	May 27, 2008	No reply.
	Comanche Tribe of Oklahoma	May 27, 2008	No reply.
	Delaware Nation	May 27, 2008	No reply.
	Delaware Tribe of Indians	May 27, 2008	No reply.
	Eastern Shawnee Tribe of Oklahoma	May 27, 2008	No reply.
	Fort Sill Apache Tribe of Oklahoma	May 27, 2008	No reply.
	Iowa Tribe of Oklahoma	May 27, 2008	No reply.
	Kaw Nation	May 27, 2008	No reply.
	Kialegee Tribal Town	May 27, 2008	No reply.
	Kickapoo Tribe of Oklahoma	May 27, 2008	No reply.
	Kiowa Tribe of Oklahoma	May 27, 2008	No reply.
	Miami Tribe of Oklahoma	May 27, 2008	No reply.
	Modoc Tribe of Oklahoma	May 27, 2008	No reply.
	Muscogee (Creek) Nation	May 27, 2008	No reply.
	Natchez Nation	May 27, 2008	No reply.
	Osage Nation of Oklahoma	May 27, 2008	Written reply of July 14, 2008. Consultation desired.
	Otoe-Missouria Tribe of Indians	May 27, 2008	No reply.
	Ottawa Tribe of Oklahoma	May 27, 2008	No reply.
	Pawnee Nation of Oklahoma	May 27, 2008	No reply.
	Peoria Indian Tribe of Indians of Oklahoma	May 27, 2008	Written reply of June 4, 2008. Consultation desired only if human remains encountered (NAGPRA).
	Ponca Tribe of Oklahoma	May 27, 2008	No reply.

Table 3.10-1 Tribal Contact List

State	Tribe	Date of Contact	Status
	Quapaw Tribe of Oklahoma	May 27, 2008	No reply.
	Sac & Fox Nation of Oklahoma	May 27, 2008	No reply.
	Seminole Nation of Oklahoma	May 27, 2008	No reply.
	Seneca-Cayuga Tribe of Oklahoma	May 27, 2008	No reply.
	Shawnee Tribe	May 27, 2008	No reply.
	Thlopthlocco Tribal Town	May 27, 2008	No reply.
	Tonkawa Tribe of Indians of Oklahoma	May 27, 2008	Written reply of May 30, 2008. Consultation desired only if human remains encountered (NAGPRA).
	United Keetoowah Band of Cherokee Indians in Oklahoma	May 27, 2008	No reply.
	Wichita and Affiliated Tribes	May 27, 2008	No reply.
	Wyandotte Nation	May 27, 2008	No reply.
	Yuchi (Euchee) Tribe of Indians[1]	May 27, 2008	No reply.
Texas	Alabama-Coushatta Tribes of Texas	May 27, 2008	Written reply of June 19, 2008. Consultation desired.
	Apalachicola Band of Creek Indians	May 27, 2008	No reply.
	Kickapoo Traditional Tribe of Texas	May 27, 2008	No reply.
	Lipan Apache Band of Texas, Inc.	May 27, 2008	No reply.
	Tonkawa Tribe of Indians of Oklahoma	May 27, 2008	Written reply of May 30, 2008. Consultation desired only if human remains encountered (NAGPRA).
	Wichita and Affiliated Tribes	May 27, 2008	No reply.

1 descendants of a historic tribe who have filed for federal recognition.

Keystone plans to continue tribal engagement during the entire duration of the cultural resource inventory and construction phases of the Project. Continued cooperation between the various SHPOs, state and federal agencies, SWCA, ARG, various tribal historic preservation offices (THPOs), and Native American tribal elders is paramount to continued protection of historical properties and respect of tribal issues.

3.11 Social and Economic Conditions

3.11.1 Socioeconomics

The Project route affects 57 counties in seven states: Montana, South Dakota, Nebraska, Kansas, Oklahoma, and Texas. New pipeline facilities will be constructed in all states except Kansas, where two new pump stations will be installed along the Keystone Cushign Extension. Counties crossed are listed by state in Table 3.11-1.

Table 3.11-1 States and Counties Crossed by the Keystone XL Project

State	Number of Counties	Counties
Montana – Steele City Segment	6	Phillips, Valley, McCone, Dawson, Prairie, Fallon
South Dakota – Steele City Segment	9	Harding, Butte, Perkins, Meade, Pennington, Haakon, Jones, Lyman, Tripp
Nebraska – Steele City Segment	14	Keya Paha, Rock, Holt, Garfield, Wheeler, Greele, Boone, Nance, Merrick, Hamilton, York, Fillmore, Saline, Jefferson
Kansas – Pump Stations	2	Clay, Butler
Oklahoma – Gulf Coast Segment	9	Atoka, Bryan, Coal, Creek, Hughes, Lincoln, Okfuskee, Payne, Seminole
Texas – Gulf Coast Segment	16	Angelina, Cherokee, Delta, Fannin, Franklin, Hardin, Hopkins, Jefferson, Lamar, Liberty, Nacogdoches, Polk, Rusk, Smith, Upshur, Wood
Texas – Houston Lateral	3	Liberty, Chambers, Harris

A list of communities that may be affected by the proposed project and their respective year 2000 population statistics are shown in Table 3.11-2. This list identifies all communities within 1.5 and 2 miles of the project.

Table 3.11-2 Affected Communities along the Project

State / Community[2]	County	Relative Proximity to Project (miles)	Population (2000)
Steele City Segment - Montana			
Nashua	Valley	2	325
Circle	McCone	2	644
Baker	Fallon	2	1,695
Steele City Segment – South Dakota			
Buffalo	Harding	2	380
Midland	Haakon	2	179
Draper	Jones	2	92
Winner	Tripp	2	3,137
Steele City Segment - Nebraska			
Ericson	Wheeler	2	104

Table 3.11-2 Affected Communities along the Project

State / Community[2]	County	Relative Proximity to Project (miles)	Population (2000)
Hordville	Hamilton	2	150
McCool Junction	York	2	385
Exeter	Fillmore	2	712
Milligan	Fillmore	2	315
Western	Saline	2	287
Steele City	Jefferson	2	84
Kansas – New Pump Stations on the Keystone Cushing Extension[3]			
Towanda	Butler	0.5	1,338
Potwin	Butler	0.5	457
Augusta[3]	Butler	2	8,423
Douglass[3]	Butler	2	1,813
Wakefield[3]	Clay	2	838
Green	Clay	2	147
Gulf Coast Segment - Oklahoma			
Stroud	Creek	2	2,758
Paden	Okfuskee	2	446
Boley	Okfuskee	2	1,126
Wewoka	Seminole	2	3,562
Allen	Pontotoc	2	951
Allen	Hughes	2	2,398
Atoka	Atoka	2	2,988
Tushka	Atoka	2	345
Caney	Atoka	2	199
Gulf Coast Segment - Texas			
Arp	Smith	0.5	901
Beaumont	Jefferson	0.5	113,866
Port Arthur	Jefferson	0.5	57,755
Central Gardens	Jefferson	0.5	4,106
Nederland	Jefferson	0.5	17,422
China	Jefferson	2	1,112
Port Neches	Jefferson	2	13,301
Tira	Hopkins	2	248

Table 3.11-2 Affected Communities along the Project

State / Community[2]	County	Relative Proximity to Project (miles)	Population (2000)
Winnsboro	Franklin	2	3,584
Winnsboro	Wood	2	3,584
Big Sandy	Upshur	2	1,288
Reklaw	Rusk	2	327
Wells	Cherokee	2	769
Hudson	Angelina	2	3,792
Diboll	Angelina	2	5,470
Corrigan	Polk	2	1,721
Houston Lateral - Texas			
Hardin	Liberty	2	755
Liberty	Chambers	2	8,033
Ames	Harris	0.5	1,079
Mont Belview	Chambers	0.5	2,324
Barrett	Harris	0.5	2,872
Highlands	Harris	2	7,089
Channelview	Harris	2	29,685
Sheldon	Harris	2	1,831
Houston	Harris	0.5	1,953,631

[1] Affected communities include those communities where new and existing pipeline facilities or surface disturbing activities associated with pipeline refurbishment are proposed.

[2] Communities are listed in order by state as the Project crosses from north to south, proximity to proposed Project centerline, and descending size based on year 2000 population.

[3] Counties on the Keystone Cushing Extension were analyzed as part of the Project and are included for clarity only; no new or additional impacts associated with construction of the Project are anticipated.

Sources: Census 2000; ESRI 2005.

Table 3.11-3 Socioeconomic Conditions in Affected Counties[1] Along the Project

State / County[2]	Population		% Change in Population	Population Density (per square mile)	Per Capita Personal Income ($)	Median Household Income ($)	Unemployment Rate (%)
	1990	2000	1990-2000	2000	1999	2004	May 2008
MONTANA – Steele City Segment	**799,065**	**902,195**	**12.9**	**6.2**	**$17,151**	**$35,574**	**3.7**
Phillips	5,163	4,601	-10.9	0.9	$15,058	$31,742	4.0
Valley	8,239	7,765	-5.8	1.6	$16,246	$34,514	3.3
McCone	2,276	1,977	-13.1	0.7	$15,162	$29,746	2.5
Dawson	9,505	9,059	-4.7	3.8	$15,368	$35,740	3.0
Prairie	1,383	1,199	-13.3	0.7	$14,422	$31,221	3.6
Fallon	3,103	2,837	-8.6	1.8	$16,014	$37,822	2.4
SOUTH DAKOTA – Steele City Segment	**696,004**	**754,844**	**8.5**	**9.9**	**$17,562**	**$39,265**	**2.8**
Harding	1,669	1,353	-18.9	0.5	$12,794	$32,895	3.1
Butte	7,914	9,094	14.9	4.0	$13,997	$33,286	2.8
Perkins	3,932	3,363	-14.5	1.2	$15,734	$30,730	3.5
Meade	21,878	24,253	10.9	7.0	$17,680	$44,516	2.9
Pennington	81,343	88,565	8.9	31.9	$18,938	$40,624	2.8
Haakon	2,624	2,196	-16.3	1.2	$16,780	$33,470	2.3
Jones	1,324	1,193	-9.9	1.2	$15,896	$31,281	2.4
Lyman	3,638	3,895	7.1	2.4	$13,862	$30,035	4.1
Tripp	6,924	6,430	-7.1	4.0	$13,776	$32,606	2.9
NEBRASKA – Steele City Segment	**1,578,385**	**1,711,263**	**8.4**	**22.3**	**$19,613**	**$42,166**	**3.1**
Keya Paha	1,029	983	-4.5	1.3	$11,860	$32,279	4.3

Table 3.11-3 Socioeconomic Conditions in Affected Counties[1] Along the Project

State / County[2]	Population 1990	Population 2000	% Change in Population 1990-2000	Population Density (per square mile) 2000	Per Capita Personal Income ($) 1999	Median Household Income ($) 2004	Unemployment Rate (%) May 2008
Rock	2,019	1,756	-13.0	1.7	$14,350	$27,512	2.3
Holt	12,599	11,551	-8.3	4.8	$15,256	$35,139	2.5
Garfield	2,141	1,902	-11.1	3.3	$14,368	$30,568	2.9
Wheeler	948	886	-6.5	1.5	$14,354	$33,834	2.9
Greeley	3,006	2,714	-9.7	4.8	$13,731	$32,241	3.3
Boone	6,667	6,259	-6.1	9.1	$15,831	$35,655	2.6
Nance	4,275	4,038	-5.5	9.2	$16,886	$35,011	2.8
Merrick	8,042	8,204	2.0	16.9	$15,958	$38,222	2.9
Hamilton	8,862	9,403	6.1	17.3	$17,590	$45,934	2.4
York	14,428	14,598	1.2	25.3	$17,670	$41,098	3.0
Fillmore	7,103	6,634	-6.6	11.5	$17,465	$38,911	2.8
Saline	12,715	13,843	8.9	24.1	$16,287	$41,876	3.0
Jefferson[3]	8,762	8,333	-4.9	14.5	$18,380	$37,559	3.3
KANSAS– Pump Stations on the Cushing Extension	**2,477,805**	**2,688,418**	**8.5**	**32.9**	**$20,506**	**$41,664**	**4.4**
Clay[3]	9,161	8,822	-3.7	13.7	$17,939	$37,306	3.4
Butler[3]	50,580	59,482	17.6	41.7	$20,150	$49,599	4.3
OKLAHOMA – Gulf Coast Segment	**3,145,537**	**3,450,654**	**9.7**	**50.3**	**$17,646**	**$37,109**	**4.2**
Atoka	12,788	13,879	8.5	14.2	$12,919	$27,211	4.0
Bryan	32,089	36,534	13.6	40.2	$14,217	$29,055	3.1

Table 3.11-3 Socioeconomic Conditions in Affected Counties[1] Along the Project

State / County[2]	Population		% Change in Population	Population Density (per square mile)	Per Capita Personal Income ($)	Median Household Income ($)	Unemployment Rate (%)
	1990	2000	1990-2000	2000	1999	2004	May 2008
Coal	5,780	6,031	4.3	11.6	$12,013	$25,525	4.9
Creek	60,915	67,367	10.6	70.5	$16,191	$36,134	3.8
Hughes	13,023	14,154	8.7	17.5	$12,687	$25,324	5.5
Lincoln	29,216	32,080	9.8	33.5	$14,890	$33,820	3.5
Okfuskee	11,551	11,814	2.3	18.9	$12,746	$26,340	3.5
Payne[3]	61,488	68,190	10.9	99.4	$15,983	$31,259	3.1
Seminole	25,412	24,894	-2.0	39.3	$13,956	$27,124	4.5
TEXAS	**16,986,410**	**20,851,820**	**22.8**	**79.6**	**$19,617**	**$41,645**	**4.3**
TEXAS – Gulf Coast Segment							
Angelina	69,884	80,130	14.7	99.9	$15,876	$35,749	4.3
Cherokee	41,049	46,659	13.7	44.4	$13,980	$30,223	5.2
Delta	5,327	4,857	-8.8	19.2	$15,080	$31,122	4.4
Fannin	24,804	31,242	26.0	35.1	$16,066	$35,434	5.2
Franklin	7,802	9,458	21.2	33.1	$17,563	$35,830	3.4
Hardin	41,230	48,073	16.6	53.8	$17,962	$41,677	4.1
Hopkins	28,833	31,960	10.8	40.9	$17,182	$33,267	3.8
Jefferson	239,397	252,051	5.3	278.8	$17,571	$35,110	5.8
Lamar	43,949	48,499	10.4	52.9	$17,000	$32,581	4.7
Liberty	52,726	70,154	33.0	60.5	$15,539	$39,120	5.2
Nacogdoches	54,753	59,203	8.1	62.5	$15,437	$29,952	4.1

Table 3.11-3 Socioeconomic Conditions in Affected Counties[1] Along the Project

State / County[2]	Population 1990	Population 2000	% Change in Population 1990-2000	Population Density (per square mile) 2000	Per Capita Personal Income ($) 1999	Median Household Income ($) 2004	Unemployment Rate (%) May 2008
Polk	30,687	41,133	34.0	38.9	$15,834	$36,368	5.8
Rusk	43,735	47,372	8.3	51.3	$16,674	$35,343	4.2
Smith	151,309	174,706	15.5	188.3	$19,072	$39,665	4.3
Upshur	31,370	35,291	12.5	60.0	$16,358	$34,690	3.8
Wood	29,380	36,752	25.1	56.5	$17,702	$34,843	4.4
TEXAS – Houston Lateral							
Liberty	*See Liberty County in Gulf Coast Segment, above*						
Chambers	20,088	26,031	29.6	43.5	$19,863	$54,474	5.3
Harris	2,818,199	3,400,578	20.7	1,966.8	$21,435	$41,922	3.8

[1] Affected counties include those counties where construction is proposed.

[2] States and counties are listed geographically from north to south as proposed project crosses the area.

[3] Information in counties on the Cushing Extension was included as part of the Keystone Pipeline Project and are included for clarity only; no new or additional impacts associated with construction of the KXL Pipeline Project are anticipated.

Sources: Census 2000.

3.11.2 Population and Employment

Table 3.11-3 summarizes the population, unemployment rate, and income trends in the counties crossed by the proposed route. The proposed route lies in predominantly rural and sparsely populated areas, with population densities generally ranging from approximately three to 50 people per square mile for the majority of the route. Exceptions to this include the southern end of the Gulf Coast Segment.

Steele City Segment

The Steele City Segment affects the states of Montana, South Dakota, and Nebraska. In general, populations of the affected counties have declined from 1990 to 2000, as the trend of rural populations moving to larger metropolitan areas continues. Only three counties in South Dakota and four counties in Nebraska recorded increasing populations from 1990 to 2000. The largest county, in terms of population, in Montana that the project affects is Dawson County. Pennington County is the largest South Dakota County affected by the project. Rapid City is located in Pennington County. York County is the largest Nebraska County affected by the project. The least populated counties in the project area are Keya Paha and Wheeler, both in Nebraska. Most of the counties affected have a very small population density, which is indicative of their rural nature. Pennington County, home of Rapid City, has the largest population density on the Steele City Segment

Cushing Extension Pump Stations

Construction of new pump stations along the Cushing Extension affect two counties in the state of Kansas. The population in Clay County has declined from 1990 to 2000, while populations in Butler County have increased. Due to its proximity to Wichita, Butler County saw a dramatic rise in population from 1990 to 2000 and has the highest population density. Butler County is also the largest County, in terms of population, affected by the new pump station construction, while the least populated county is Clay County. Most of Butler and Clay County are rural in nature.

Gulf Coast Segment

The Gulf Coast Segment affects the states of Kansas and Texas. Populations of the all the affected counties have increased from 1990 to 2000, with the exception of Seminole County Oklahoma and Delta County Texas. The most populated affected county in Oklahoma is Payne County, which includes part of the Stillwater Micropolitan Statistical Area. Coal County is the least populated affected county in Oklahoma. Jefferson County is the largest county in Texas, in terms of population, affected by the Gulf Coast Segment as it is contains the cities of Beaumont and Port Arthur. The least populated Texas County in the project area is Delta County. Many of these counties have higher population densities than the other project segments, as greater population centers are encountered.

Houston Lateral

The Houston Lateral affects three counties in the state of Texas. Populations in all the affected counties have increased dramatically from 1990 to 2000. Liberty County saw the largest percentage increase in size, while Harris County is the most populated county affected by the lateral. The least populated county is Chambers County. Liberty and Chambers both have population densities that are lower than the Texas state average and our predominantly rural, Harris County, however, home to Houston, has a population density that is 2,371 times the state average and is urban in nature.

3.11.3 Income

Steele City Segment

Along the Steele City Segment, a total of two counties have per capita personal incomes that are higher than the state average. The two counties, Meade and Pennington, are both located in South Dakota and contain larger metropolitan areas, Spearfish and Rapid City, respectively. The remainder of the counties had per capita personal income lower than the state averages. Keya Paha and Greeley counties in Nebraska, both had the lowest per capita personal income in absolute terms and when compared to the state average than any other county along the Steele City Segment. Five counties had median household income that was higher than their state averages. Most of the counties were below the state average, with Rock County Nebraska, being the lowest. The unemployment rate for affected counties deviated from the state average by usually one percentage point, plus or minus. Exceptions to this were Lyman County South Dakota and Keya Paha Nebraska, which had unemployment rates that were greater than one percentage point of the state average.

Cushing Extension Pump Stations

Both affected counties have per capita personal incomes that are lower than the Kansas state average. Clay County had a median household income that was lower than the state average. Butler County had a median household income that was 19 percent above the state average. The unemployment rate for affected counties was either the same or less than the state average. Clay County had unemployment rates that were more than one full percentage point lower than their state averages.

Gulf Coast Segment

All of the affected counties, with the exception of Smith County Texas, have per capita personal incomes that are lower than the Oklahoma and Texas state averages. The highest was Smith County. Coal Creek Oklahoma and Cherokee County Texas each had the lowest per capita personal incomes in their respective states. Only one county along the Gulf Coat Segment, Hardin County Texas, had a median household income that was higher than the state average. Every other county was lower than the state average with Nacogdoches County the lowest in Texas and Seminole County the lowest in Oklahoma. The unemployment rate for affected counties deviated from the state averages by usually one percent, plus or minus. Exceptions to this were Hughes County Oklahoma and Jefferson and Polk Counties Texas, which had unemployment rates that were in excess of one percentage point of the state average.

Houston Lateral

Two of the three affected counties have per capita personal incomes that are lower than the Texas state average, with the lowest being Liberty County. The highest was Harris County. Two of the three of the affected counties had median household income that was higher than the Texas state average. The county with the lowest median household income was Liberty County, while Butler, with a median household income that was 30.8 percent above the state average, had the highest. The unemployment rate for affected counties deviated from the state averages by usually one percentage point, plus or minus. Chambers County had an unemployment rate that was one full percentage point higher than the state average, making it the highest of the affected counties.

3.11.4 Infrastructure

Housing

Housing availability across the proposed route is a function of the housing stock, recent economic and population growth, the inventory of short-term lodging accommodations, such as recreational vehicle (RV) parks and hotel and motel rooms, and demand for housing from other sources. A key indicator of housing

availability to meet short-term needs is the number of available rental units. Table 3.11-4 summarizes the base housing stock in counties crossed by the project.

Steele City Segment

Counties along this segment tend to have very low housing supply and a low level of new development. The lowest rental housing supply and growth occur throughout Montana and South Dakota, with the exception of Dawson County Montana, and Meade and Pennington counties South Dakota. Additionally, the northern most counties of Nebraska have extremely low housing availability and new development. More housing possibilities are available in southern Nebraska as the I-80 corridor comes into play. Counties in Nebraska that have some of the most total rental units and growth are York and Hamilton counties.

The most pertinent component of local housing markets for purposes of the Project is the inventory of short-term accommodations. Such accommodations include RV spaces, motel and hotel rooms, and campgrounds. In some instances, recreational cabins and seasonal housing for migratory workers also may be available. Most of the rural counties along the Steele City segment had a very limited supply of short-term housing. In some counties, such as Keya Paha and Wheeler, there are less than 125 total rental units in each county in addition to an extreme scarcity of RV spaces and hotel/motel rooms. The greatest supply of short-term accommodations was in the counties with urban centers, such as Pennington and Meade counties South Dakota, and York County Nebraska. Arranging housing for project workers in the more sparsely populated counties along this segment will be challenging.

Cushing Extension Pump Stations

Counties along this segment, when compared to the Steele City Segment, have an increased rental housing supply, as well as a greater number, in general, of hotel and motel rooms per county, in comparison to the Steele City Segment. The lowest rental housing supply occurred in Clay County Kansas. Butler County has the greatest amount of total rental units.

The most pertinent component of local housing markets for purposes of the Project is the inventory of short-term accommodations. Such accommodations include RV spaces, motel and hotel rooms, and mobile home spaces. In some instances, recreational cabins and seasonal housing for migratory workers also may be available. Both counties affected have a significant supply of short-term accommodations due to their proximity to urban areas, such as Wichita.

Gulf Coast Segment

Counties along this segment have a significant supply of total rental units. The lowest supply of total rental units occurred in Delta County Texas, while the Jefferson County Texas had the greatest supply of total rental units. The majority of the counties along the Gulf Coast segment have a total amount of rental units each well in excess of 1,000 units. The most pertinent component of local housing markets for purposes of the Project is the inventory of short-term accommodations. Such accommodations include RV spaces, motel and hotel rooms, and mobile home spaces. In some instances, recreational cabins and seasonal housing for migratory workers also may be available. Most of the counties affected along this segment have an adequate supply of short-term accommodations. Counties that have a low supply of short-term accommodations, such as Delta and Franklin, border counties with more significant populations and lodging options.

Houston Lateral

Counties along this lateral have a high supply of total rental units and high level of new development. The lowest rental housing supply can be found in Chambers County. Harris County boasts the most total rental units and growth along the lateral. The city of Houston lies within Harris County. Liberty, Chambers, and Harris counties have a combined total of 597,423 rental housing units.

The most pertinent component of local housing markets for purposes of the Project is the inventory of short-term accommodations. Such accommodations include RV spaces, motel and hotel rooms, and mobile home spaces. In some instances, recreational cabins and seasonal housing for migratory workers also may be available. Due to the proximity of major urban areas, such as Houston, Beaumont, and Port Arthur, there is no shortage of short-term accommodations along the lateral.

Table 3.11-4 Housing Assessment for Counties along the Project

State / County[1]	Total Housing Units (2000)	Total Rental Units (2000)	Rental Vacancy Rate (%) (2000)	Hotel/ Motel Rooms	RV Sites	Building Permits (2006)
Steele City Segment - Montana						
Phillips	2,502	632	14.1	126	40	0
Valley	4,847	826	7.9	253	44	1
McCone	1,087	240	25.8	14	0	0
Dawson	4,168	1,076	12.5	277	94	3
Prairie	718	143	15.4	0	9	0
Fallon	1,410	333	22.5	91	18	0
Montana Total	**14,732**	**3,250**	**16.4 (avg)**	**761**	**205**	**4**
Steele City Segment – South Dakota						
Harding	804	152	8.6	20	0	0
Butte	4,059	1,119	15.9	222	93	91
Perkins	1,854	396	15.4	90	0	5
Meade	10,149	3,105	9.9	398	465	118
Pennington	37,249	12,516	6.4	4,045	1,895	838
Haakon	1,002	233	13.3	29	21	3
Jones	614	159	11.9	189	200	5
Lyman	1,636	477	10.1	390	166	6
Tripp	3,036	736	12.4	194	20	0
South Dakota Total	**60,403**	**18,893**	**11.5 (avg)**	**5,577**	**2,860**	**1,066**
Steele City Segment - Nebraska						
Keya Paha	548	124	8.1	0	20	3
Rock	935	216	4.6	36	0	3
Holt	5,281	1,376	11.6	198	19	8
Garfield	1,021	257	13.2	28	25	2
Wheeler	561	117	7.7	0	0	0

Table 3.11-4 Housing Assessment for Counties along the Project

State / County[1]	Total Housing Units (2000)	Total Rental Units (2000)	Rental Vacancy Rate (%) (2000)	Hotel/ Motel Rooms	RV Sites	Building Permits (2006)
Greeley	1,199	244	5.3	0	0	0
Boone	2,733	676	9.8	34	0	11
Nance	1,787	440	9.3	16	0	7
Merrick	3,649	896	7.4	33	0	30
Hamilton	3,850	956	8.8	10	45	28
York	6,172	1,905	8.3	575	4	22
Fillmore	2,990	742	7.5	26	0	6
Saline	5,611	1,598	4.8	77	48	62
Jefferson	3,942	932	9.4	45	0	21
Nebraska Total	**40,279**	**10,479**	**8.3 (avg)**	**1,078**	**161**	**203**
Kansas – Cushing Extension New Pump Stations						
Clay	4,084	973	13.6	55	0	20
Butler	23,176	5,327	9.8	301	36	408
Kansas Total	**27,260**	**15,960**	**11.7 (avg)**	**356**	**36**	**428**
Oklahoma – Gulf Coast Segment						
Payne	29,326	12,680	7.3	650	0	167
Lincoln	13,712	2,738	10.9	145l	29	24
Creek	27,986	6,182	10.1	142	0	228
Okfuskee	5,114	1,138	10.6	47	0	5
Seminole	11,146	2,991	12.0	141	0	21
Hughes	6,237	1,403	8.2	13	0	4
Coal	2,744	653	9.6	27	0	1
Atoka	5,673	1,354	12.9	54	0	7
Bryan	16,715	4,887	9.7	203	159	415
Oklahoma Total	**145,539**	**41,411**	**10.4 (avg)**	**1,422**	**188**	**910**
Gulf Coast Segment - Texas						
Fannin	12,887	3,167	11.5	53	0	44
Lamar	21,113	6,902	9.4	621	0	81
Delta	2,410	506	5.9	0	0	11
Hopkins	14,020	4,034	12.7	466	0	14

Table 3.11-4 Housing Assessment for Counties along the Project

State / County[1]	Total Housing Units (2000)	Total Rental Units (2000)	Rental Vacancy Rate (%) (2000)	Hotel/ Motel Rooms	RV Sites	Building Permits (2006)
Franklin	5,132	907	13.0	44	0	4
Wood	17,939	3,003	9.7	61	0	14
Upshur	14,930	2,745	11.7	74	0	67
Smith	71,701	22,065	9.8	1,937	180	679
Cherokee	19,173	4,895	10.0	222	0	33
Rusk	19,867	3,891	10.3	240	0	8
Nacogdoches	25,051	9,334	9.4	106	24	256
Angelina	32,435	8,810	10.1	920	0	185
Polk	21,177	3,212	13.9	281	215	460
Liberty	26,359	5,405	9.6	168	0	293
Hardin	19,836	3,545	12.9	108	0	129
Jefferson	102,080	34,997	9.7	2,911	144	1,576
Texas Gulf Coast - Total	**436,446**	**119,222**	**11.0 (avg)**	**8,182**	**563**	**4,222**
Houston Lateral						
Chambers	10,336	1,804	17.0	202	110	368
Harris	1,298,130	590,214	8.7	12,180	501	46,455
Texas – Houston Lateral Total	**1,308,466**	**592,018**	**25.7**	**12,382**	**611**	**46,823**
PROJECT TOTAL	**2,033,125**	**801,233**	**11.5 (avg)**	**29,758**	**4,624**	**53,656**

1 States and counties are listed geographically from north to south as proposed project crosses area.

2 Housing in counties on the Cushing Extension were analyzed as part of the Keystone Pipeline Project and are included for clarity only. Construction in these counties will be related to pump stations only except in Jefferson County, NE, and Payne County, OK, where some new pipeline construction will occur.

NA = Data not available.

Sources: Census 2000a,b.

3.11.5 Public Services and Facilities

Table 3.11-5 outlines selected public services and facilities serving the proposed project area. In general, the public services available are functions of the size and population of the county and the number of larger communities in the county. There are multiple law enforcement providers including the respective state patrols, county sheriffs, local police departments, and special law enforcement services, such as university police. In many instances, mutual aid/cooperative agreements among agencies allow members of one agency to provide support or backup to other agencies in emergency situations.

A network of fire departments and districts provide fire protection and suppression services across the region. Many of the fire districts across the project area are staffed by volunteers and are housed in stations located in the larger communities.

Table 3.11-5 lists the critical access facilities for each county that are within approximately 50 miles of the proposed route. Non-federal, short-term, acute care facilities nearest the route also are identified on the table. For each county along the proposed route there is at least one acute care facility either within the county crossed or near the proposed route in a neighboring county, providing emergency medical care and in several cases also serving as the base for local emergency medical response and transport services.

3.11.6 Fiscal Relationships

Employing a cost approach, states generally assess the value of pipelines to facilitate consistent valuation over all the counties crossed within the state. The resultant value is assigned to affected counties and taxing jurisdictions and property taxes are assessed accordingly. The effective property tax rates are then calculated using state property tax levies for pipelines, county property tax levies on pipelines, or a combination of the two. Table 3.11-6 lists the various property tax mill levy values for the pipeline as well as the effective tax rates for each county along the Project.

Property taxes on pipelines in Montana are calculated using a tax rate between 3.78 and 8.66 percent. In South Dakota, a straight 1.84 percent property tax is applied in all counties in the state, while Nebraska uses varying county-based property taxes only, ranging from approximately 1.5 to 2.0 percent. Property taxes on pipelines in Kansas employ a combination of a 33 percent flat state property tax rate and county mill levies of approximately 10 to 14 percent to yield effective property rates ranging from approximately three to five percent in counties where pump stations will be built. The portion of the Project in Oklahoma employs a combination of a flat property tax rate of 22.85 percent for the state and another flat rate of 10.5 percent for each county for a consistent effective tax rate of 2.4 percent. Counties along the Gulf Coast Segment and the Houston Lateral in the state of Texas use an effective tax rate between 2.1 and 1.1 percent.

Other taxes levied by various state, county, or local taxing jurisdictions may include taxes on gross receipts from the sales of goods and services and corporate income taxes. Federal agencies also assess fees for use of public lands for activities such as pipeline and transmission line ROWs. These taxes and fees vary by region and have not been identified for the Project.

Table 3.11-5 Existing Public Services and Facilities Along the Project Route

State / County[1]	Police/Sheriff Departments[2]	Fire Departments[2]	Nearest Medical Facilities[3]
Keystone XL Project			
Steele City Segment - Montana			
Phillips	1	2	Phillips County Hospital (Malta)
Valley	4	3	Frances Mahon Deaconess Hospital (Glasgow)
McCone	2	1	McCone County Health Center (Circle)
Dawson	2	4	Glendive Medical Center (Glendive)
Prairie	2	1	Prairie Community Health Center (Terry)
Fallon	2	2	Fallon Medical Complex (Baker)
Steele City Segment – South Dakota			
Harding	2	3	
Butte	2	3	
Perkins	3	2	
Meade	4	6	Sturgis Regional Hospital (Sturgis)
Pennington	5	14	Rapid City Regional Hospital (Rapid City)
Haakon	2	3	Hans P. Peterson Memorial Hospital (Philip)
Jones	2	1	
Lyman	1	3	
Tripp	2	1	Winner Regional Healthcare Center (Winner)
Steele City Segment - Nebraska			
Keya Paha	1	2	
Rock	1	0	Rock County Hospital (Bassett)

Table 3.11-5 Existing Public Services and Facilities Along the Project Route

State / County[1]	Police/Sheriff Departments[2]	Fire Departments[2]	Nearest Medical Facilities[3]
Holt	5	2	Avera St. Anthony's Hospital (O'Neil)
Garfield	3	0	Valley County Hospital: Burwell Medical Clinic (Burwell)
Wheeler	1	0	
Greeley	2	3	
Boone	4	3	Boone County Health Center (Albion)
Nance	1	2	
Merrick	4	3	Litzenberg Memorial County Hospital (Central City)
Hamilton	2	4	Memorial Hospital (Aurora)
York	2	3	York General Hospital (York)
Fillmore	3	6	Fillmore County Hospital (Geneva)
Saline	4	5	
Jefferson	3	5	Jefferson Community Health Center (Fairbury); Thayer County Health Services (Hebron)
Kansas – Keystone Cushing Extension Pump Stations			
Clay[4]	4	3	Clay County Medical Center (Clay Center); *Mercy Regional Health Center (Manhattan)
Butler[4]	8	12	*Newton Medical Center (Newton); *Susan B. Allen Memorial Hospital (El Dorado); *Via Christi Riverside Medical Center (Wichita); *Wesley Medical Center (Wichita)
Gulf Coast Segment - Oklahoma			

Table 3.11-5 Existing Public Services and Facilities Along the Project Route

State / County[1]	Police/Sheriff Departments[2]	Fire Departments[2]	Nearest Medical Facilities[3]
Lincoln	9	6	Prague Municipal Hospital (Prague); Stroud Regional Medical Center (Stroud)
Creek	10	10	Bristow Medical Center (Bristow); Sapulpa Hospital (Sapulpa); Saint John Sapulpa (Sapulpa
Okfuskee	4	6	Creek Nation Community Hospital (Okemah)
Seminole	5	6	Seminole Medical Center (Seminole)
Hughes	3	4	Holdenville General Hospital (Holdenville)
Coal	3	4	Mary Hurley Hospital (Coalgate)
Atoka	3	7	Atoka Memorial Hospital (Atoka)
Bryan	8	12	Medical Center of Southeastern Oklahoma (Durant)
Gulf Coast Segment - Texas			
Fannin	8	6	Northeast Medical Center (Bonham)
Lamar	7	12	Saint Joseph's (Paris); Dubuis Hospital of Paris (Paris); Paris Regional Medical Center (Paris)
Delta	5	2	Wintermute Memorial Hospital (Klondike)
Hopkins	5	8	Hopkins County Memorial Hospital (Sulphur Springs)
Franklin	2	3	East Texas Medical Center (Mt. Vernon)
Wood	6	6	Presbyterian Hospital of Winnsboro (Winnsboro)
Upshur	4	7	

Table 3.11-5 Existing Public Services and Facilities Along the Project Route

State / County[1]	Police/Sheriff Departments[2]	Fire Departments[2]	Nearest Medical Facilities[3]
Smith	8	9	East Texas Medical Center (Tyler); Mother Frances Hospital (Tyler); University of Texas Health Center (Tyler)
Cherokee	5	6	Mother Frances Hospital (Jacksonville); Rusk State Hospital (Rusk)
Rusk	6	6	Henderson Memorial Hospital (Henderson)
Nacogdoches	4	11	Nacogdoches Medical Center (Nacogdoches)
Angelina	6	8	Woodland Heights Medical Center (Lufkin)
Polk	4	8	Memorial Medical Center (Livingston)
Liberty	6	11	Cleveland Regional Medical Center (Cleveland); Kersting Hospital (Liberty); Leggett Memorial Hospital (Cleveland); Liberty-Dayton Hospital (Liberty)
Hardin	6	4	
Jefferson	10	8	Saint Elizabeth Hospital (Beaumont); Debuis Hospital of Beaumont (Beaumont); Memorial Herman Baptist (Beaumont) Saint Mary Hospital (Port Arthur); Promise Specialty Hospital of Southeast Texas (Port Arthur); Mid-Jefferson Hospital (Nederland);
Houston Lateral - Texas			
Liberty	*See Liberty*		

Table 3.11-5 Existing Public Services and Facilities Along the Project Route

State / County[1]	Police/Sheriff Departments[2]	Fire Departments[2]	Nearest Medical Facilities[3]
	County in Gulf Coast Segment, above		
Chambers	4	5	Bayside Community Hospital & Clinic (Anahuac)
Harris	36	41	Bay Area Surgicare Center (Webster); Bayshore Medical Center (Pasadena); Bayou City Medical Center (Houston); Ben Taub General Hospital (Houston); Children's Memorial Hermann Hospital (Houston); Saint Catherine Hospital (Katy); Saint John Hospital (Nassau Bay); Saint Joseph Hospital (Houston); Clear Lake Regional Medical Center (Webster); Cypress Creek Hospital (Houston); Cypress Fairbanks Medical Center (Houston); Dubuis Hospital of Houston (Houston); East Houston Regional Medical Center (Houston); Lyndon B. Johnson General Hospital (Houston); Quentin Mease Community Hospital (Houston); Kingwood Medical Center (Kingwood); Spring Branch Medical Center (Houston); West Houston Medical Center (Houston);

Table 3.11-5 Existing Public Services and Facilities Along the Project Route

State / County[1]	Police/Sheriff Departments[2]	Fire Departments[2]	Nearest Medical Facilities[3]
			Women's Hospital of Texas (Houston)
			Hermann Hospital (Houston);
			Kindred Hospital Bay Area (Pasadena);
			Kindred Hospital Houston (Houston);
			Kindred Hospital Houston Northwest (Houston);
			Memorial Hermann Northwest Hospital (Houston); Memorial Hermann Katy Hospital (Katy);
			Memorial Hermann Southeast Hospital (Houston);
			Memorial Hermann Southwest Hospital (Houston);
			Methodist Hospital (Houston);
			Methodist Willowbrook Hospital (Houston);
			San Jacinto Methodist Hospital (Houston);
			Michael E. Debakey VA Medical Center (Houston);
			Park Plaza Hospital (Houston);
			Parkview Community Hospital (Houston)
			Saint Joseph Hospital (Houston);
			Saint Luke's Episcopal Hospital (Houston);
			Twelve Oaks Medical Center (Houston);
			West Houston Medical Center (Houston);
			West Oaks Hospital (Houston)

1 States and counties are listed geographically from north to south as proposed project crosses the area.

2 Includes special law enforcement units for universities. Includes volunteer, district, city, and town fire departments (Capitol Impact 2006).

3 All facilities listed are critical access facilities within approximately 50 miles of the project; those marked with and asterisk (*) are non-federal, short-term, acute care facilities. AHD 2006.).

4 Construction in these counties will be related to pump stations only.

Table 3.11-6 Property Mill Levies and Tax Rates for the Project

State/County[1]	Property Tax Mill Levy (mills) on the pipeline	Effective Tax Rate (%)
Steele City Segment - Montana		
Phillips	$6,373,781	6.15
Valley	$12,788,963	5.81
McCone	$15,849,656	6.3
Dawson	$11,039,339	8.66
Prairie	$5,434,242	6.09
Fallon	$9,387,828	3.78
Steele City Segment – South Dakota		
Harding	$3,346,244	1.84
Butte	$134,730	1.84
Perkins	$624,306	1.84
Meade	$2,608,096	1.84
Pennington	$41,365	1.84
Haakon	$2,818,539	1.84
Jones	$2,044,666	1.84
Lyman	$489,057	1.84
Tripp	$3,298,393	1.84
Steele City Segment - Nebraska		
Keya Paha	$1,133,796	1.5
Rock	$649,588	1.71
Holt	$3,548,059	1.71
Garfield	$659,714	1.69
Wheeler	$1,328,431	1.31
Greeley	$1,714,863	1.73
Boone	$222,867	1.69
Nance	$1,280,136	1.85
Merrick	$1,581,338	1.88
Hamilton	$499,036	1.66
York	$2,175,921	1.78
Fillmore	$1,577,037	1.82

Table 3.11-6 Property Mill Levies and Tax Rates for the Project

State/County[1]	Property Tax Mill Levy (mills) on the pipeline	Effective Tax Rate (%)
Saline	$1,339,885	1.96
Jefferson	$4,184,344	1.84
Kansas – Keystone Cushing Extension Pump Station Upgrade		
Clay[2]	$1,542,806	3.85
Butler[2]	$453,949	3.85
Gulf Coast Segment - Oklahoma		
Lincoln	$1,620,262	2.4
Creek	$411,919	2.4
Okfuskee	$1,239,748	2.4
Seminole	$2,169,785	2.4
Hughes	$2,188,917	2.4
Coal	$2,604,589	2.4
Atoka	$1,568,644	2.4
Bryan	$2,494,487	2.4
Gulf Coast Segment - Texas		
Fannin	$415,734	1.56
Lamar	$1,514,314	1.41
Delta	$1,550784	2.07
Hopkins	$573,610	1.37
Franklin	$1,098,306	1.39
Wood	$1,863,930	1.42
Upshur	$348,966	1.49
Smith	$1,645,008	1.1
Cherokee	$1,393,088	1.51
Rusk	$646,068	1.23
Nacogdoches	$1,139,530	1.53
Angelina	$1,470,148	1.41
Polk	$3,015,148	1.44
Hardin	$593,311	1.32
Liberty	$4,156,875	1.57
Jefferson	$1,618,688	1.39

Table 3.11-6 Property Mill Levies and Tax Rates for the Project

State/County[1]	Property Tax Mill Levy (mills) on the pipeline	Effective Tax Rate (%)
Houston Lateral - Texas		
Liberty	See Above	1.57
Chambers	$207,106	1.41
Harris	$667,702	1.42

[1] States and counties are listed geographically from north to south as proposed project crosses the area.
[2] Construction in these counties will be related to pump stations only.
Source: Information was based on discussions with the counties to obtain current local tax rates and valuation methodology.

3.11.7 Environmental Justice

Executive Order ("EO" or "Order") 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (59 FR 7629) requires that impacts on minority or low-income populations be taken into account when preparing environmental and socioeconomic analyses of projects or programs that are proposed, funded, or licensed by federal agencies. The Environmental Justice Guidance under NEPA prepared by the Council on Environmental Quality (CEQ Guidance) (1997) is commonly used in implementing EO 12898 in preparing NEPA documents.

The purpose of the Order is to avoid the disproportionate placement of any adverse environmental, economic, social, or health impacts from federal actions and policies on minority populations, low-income populations, and Indian tribes and to allow all portions of the population an opportunity to participate in the development of, compliance with, and enforcement of federal laws, regulations, and policies affecting human health of the environment regardless of race, color, national origin, or income. The provisions of the Order apply to programs involving Native Americans and Hispanic communities. These requirements will be addressed by a) ensuring broad distribution of public information on the Project through public scoping meetings and b) conducting government-to-government consultation with Native American groups either residing in or with historical ties to the project area. For an expanded discussion of Native American consultation, see Section 3.10, Native American Consultation.

Tables 3.11-7 and 3.11-8 provide 2000 Bureau of the Census statistics on race, ethnicity, and income status in affected counties and communities for the Project, respectively. Affected counties are those counties crossed by the Project, including new and upgraded pump stations along the Keystone Cushing Extension. Affected communities in the proximity of the proposed routes include those communities crossed by the proposed route (within one-half mile) as well as communities located within two miles of the proposed route The sections below discuss the minority populations and low income populations potentially affected by the Project.

Minority Populations

The CEQ Guidance defines the term "minority population" to include people who identify themselves during the Census as Black or African American, Asian or Pacific Islander, Native American or Alaskan Native, or Hispanic. Hispanic origin refers to ethnicity and language, not race, and may include people whose heritage is Puerto Rican, Cuban, Mexican, and Central or South American. For the purpose of this evaluation, all people who identified themselves as Hispanic are included as a minority population.

In accordance with the CEQ Guidance, minority populations should be identified where either a) the minority population in an affected area (e.g., a County or community) exceeds 50 percent; or b) the minority population percentage of the affected area is meaningfully greater (1.5 times) than the minority population percentage in the general population of the surrounding area (e.g., the State, county, or other appropriate unit of geographical analysis). For this ER, surrounding area used for comparison of affected counties / communities were the state populations.

Based upon review of the 2000 Census data, there are minority populations located in a few counties crossed and several communities in the proximity of the proposed route. As described below, in some cases, there are minority populations occurring in portions of the counties crossed by the proposed route that are "meaningfully greater" than their corresponding minority populations in the general population. Figure 3.11-1 displays the three counties determined to have "meaningfully greater" minority populations as compared to the respective states. Therefore, as defined in the CEQ Guidance for the purposes of identifying potential environmental justice concerns, minority populations live within the study area.

Steele City Segment

The Steele City Segment traverses six counties in Montana, nine counties in South Dakota and 14 counties in Nebraska. Of those counties, only one county, Lyman County South Dakota, has a meaningfully greater minority population, compared to that of the state. On average, 12.7 percent of South Dakota's population is "non-white" or "minority. Nearly 36 percent of Lyman County is non-white (greater than 1.5 times the state average); the majority of these people characterize themselves as Native American or Alaskan Native.

None of the affected communities along the Steel City Segment as listed in Table 3.11-8 have a meaningfully greater minority population compared to their respective states.

New Pump Station locations on the Keystone Cushing Extension

There are two new pump stations located in two counties in Kansas along the Keystone Cushing Extension. Neither of these counties have high-minority populations as defined by CEQ guidance.

Gulf Coast Segment

The Gulf Coast Segment travels through eight counties in Oklahoma, none of which have minority populations significantly greater than that of the state. There are two communities located approximately two miles of the Gulf Coast Segment in Oklahoma with high minority populations. The minority populations within the communities of Boley and Wewoka are meaningfully greater than their respective counties and the state of Oklahoma. Over 67 percent of the population in the community of Boley (Okfuskee County, OK) is non-white, nearly 55 percent of which are black. Wewoka, Seminole County has a minority population of 51.3 percent. Approximately 21 percent of the Wewoka community is Native American, and nearly 20 percent of the Wewoka community is black.

Within Texas, only one of the 16 counties comprising the Gulf Coast Segment has a minority population meeting the significance threshold. The population of Jefferson County Texas has a minority population that exceeds 50 percent (specifically, 53.2 percent); the black population is the largest minority group (33.7 percent) followed by the Hispanic population (10.5 percent). The state of Texas averages a total minority population of 61.1 percent (the majority of this population is Hispanic with 32 percent, followed by an 11.5 percent black population). Although the total minority population within Jefferson County exceeds 50 percent, it is actually less than the state average.

The city of Port Arthur, located in Jefferson County Texas is located within 0.5 miles of the Gulf Coast Segment meets the criteria for a "significant" minority population. Over 78 percent of the people in Port Arthur are a minority, nearly 44 percent of which are black and nearly 18 percent are Hispanic. The total non-white population is over 50 percent, but not quite 1.5 times greater than Jefferson County, nor the state of Texas.

Similarly, over 64 percent of the population of Beaumont (Jefferson County) is a minority, with a large black population of nearly 46 percent. Diboll is located approximately two miles from the Project and reports 83.7 percent of its population to be minority, 37.3 of which are Hispanic, 24.1 percent are black and 19.4 percent are some other race. Corrigan is also located within two miles of the Project in Polk County and has a minority population of over 66 percent.

Houston Lateral

The Houston Lateral travels through three counties in Texas, one of which has a minority population greater than 50 percent. Harris County has a total minority population of 74.2 percent. The minority populations include 32.9 percent Hispanic, 18.5 percent black and 14.2 percent categorized themselves as “other”. The minority population living in Harris County is not meaningfully different than the state of Texas, which has a 61.1 percent total minority population, the majority of which are Hispanic.

The communities of Barrett, Houston, Channelview and Sheldon (all located within Harris County) each have minority populations greater than 50 percent. Barrett’s population is over 86 percent black. The cities of Houston, Channelview and Sheldon each have large Hispanic populations.

Low-Income Populations

Low income populations were identified along the proposed project route by comparing the percent of the population below the poverty level (according to 2000 Census data) in the affected counties and communities to the percent of the population below the poverty level in each respective state. If the percent in the affected county or community was greater than the percent in the state, the affected county or community was determined to be a low-income population. The figure depicts those counties with a percent of the population below the poverty level greater than the respective states, not whether the low income populations are “significantly” greater. The percentage of families with incomes below the poverty level for the affected counties and communities are identified on Tables 3.11-7 and 3.11-8. Counties and communities with a poverty level greater than the state or county are discussed below; a county was considered to have a “significantly” greater low-income community if its low-income population was 1.5 times greater than that of the state.

Steele City Segment

Within Montana, four counties (Philips, McCone, Dawson, and Prairie) have a greater percentage of families living below the poverty level than the state on average; however none of these are significantly greater than the state. The town of Circle, located within McCone County and within two miles from the Steele City Segment has 16.2 percent of its families living below the poverty level (as compared with 14.1 percent in the county and 10.5 percent in the state). This is a significantly greater percentage than that of the state.

Seven counties along the South Dakota portion of the Steele City Segment have a greater percentage of families living below the poverty level than the state on average (Harding, Butte, Perkins, Haakon, Jones, Lyman and Tripp). The counties of Harding, Lyman and Tripp each have significantly greater low-income populations than South Dakota’s average of 9.3 percent. The community of Draper (Jones County) has significantly more families living below the poverty level than that of the state. Winner (Tripp County) has a higher percentage of low-income families than South Dakota on average, but the difference is not significant.

The Steel City Segment travels through 14 counties in Nebraska; 10 of these counties have a higher percentage of families living below the poverty level than the state on average. Five counties in Nebraska have a significantly greater low-income population than the state: Keya Paha, Rock, Wheeler, Greeley and Nance. The town of Miligan (Filmore County) is located within two miles from the pipeline route and has significantly more families living below the poverty level than the state of Nebraska. The communities of Hordville (Hamilton County) and Steele City (Jefferson County) are both located within two miles of the project and have a higher percentage of families living below the poverty level than the State.

New Pump Station locations on the Keystone Cushing Extension

One of the two counties in Kansas have a greater percentage of families living below the poverty level than the state (Clay County). The low income population within this County is not significantly different than the State's.

Gulf Coast Segment

Within the Gulf Coast Segment of Oklahoma, six counties (Atoka, Bryan, Coal, Hughes, Okfuskee and Seminole) have a greater percentage of families living below the poverty level than the state on average; two of these are significantly greater than the state (Coal and Okfuskee). Three communities in Atoka County (Atoka, Tushka and Caney) each have significantly more families living below the poverty level than the state of Oklahoma. The communities of Boley (Okfuskee County) and Wewoka (Seminole Count) also have significantly more families living below the poverty level than the state of Oklahoma. Stroud (Creek County) and Allen (located in Hughes and Pontotoc counties) each have a larger low-income population than the state on average, but not significantly.

For the Texas portion of the Gulf Coast Segment, nine counties (Angelina, Cherokee, Delta, Franklin, Jefferson, Lamar, Nacogdoches, Polk and Upshur) have a greater percentage of families living below the poverty level than the state on average; however, none of these are significantly greater than the state. Within Jefferson County, Beaumont, Port Arthur and China have more families living below the poverty level than Texas (the difference is significant for Port Arthur). The communities of Big Sandy (Upshur County), Wells (Cherokee County), Diboll (Angelina County) and Corrigan (Polk County) are each located approximately two miles from the Gulf Coast Segment and have a greater percentage of families living below the poverty level than the state of Texas. The difference is significant for each except Big Sandy.

Houston Lateral

The state of Texas population includes 12 percent of families below the poverty level. Harris County, part of the Houston Lateral, has 12.1 percent of families below the poverty level, which is greater than the state, but not significantly. The community of Barrett (Harris County) has significantly more families below the poverty level than the state of Texas. The cities of Houston (Harris County) and Liberty (Liberty County) each have a greater percentage of families living below the poverty level than the state of Texas, but the difference is not considered to be significant.

Table 3.11-7 Environmental Justice Statistics in Affected Counties[1]

State / County[2]	Total Population 2000	Racial/Ethnic Categories (% of total population, 2000)[3]							Median Family Income (1999)[5]	Families With Income Below the Poverty Level[6] (%) (1999)
		White	Black	Native American or Alaskan Native	Asian or Pacific Islander	Hispanic[4]	Other	Two or More Races		
Steele City Segment - Montana										
Phillips	4,60	89.4	0.2	7.6	0.3	1.2	0.4	2.1	$37,259	13.8
Valley	7,67	88.1	0.1	9.4	0.2	0.8	0.3	1.8	$39,044	9.5
McCone	1,97	97.0	0.3	1.1	0.3	1.0	0.0	1.4	$35,887	14.1
Dawson	9,05	97.4	0.3	1.2	0.1	0.9	0.3	0.6	$38,455	11.7
Prairie	1,19	98.0	0.0	0.5	0.2	0.7	0.2	1.2	$32,292	13.3
Fallon	2,83	98.6	0.1	0.3	0.4	0.4	0.1	0.5	$38,636	9.5
Steele City Segment – South Dakota										
Harding	1,353	97.6	0.3	0.7	0.6	1.6	0.4	0.4	$31,667	19.4
Butte	9,094	95.5	0.1	1.6	0.2	2.9	1.1	1.4	$34,173	9.4
Perkins	3,363	96.6	0.1	1.6	0.2	0.7	0.5	0.8	$33,537	12.4
Meade	24,253	92.7	1.5	2.0	0.6	2.1	0.6	2.5	$40,537	7.9
Pennington	88,656	86.7	0.9	8.1	1.0	2.6	0.7	2.7	$44,796	8.6
Haakon	2,196	96.4	0.0	2.5	0.1	0.6	0.0	1.0	$35,958	12.0
Jones	1,193	95.8	0.0	2.4	0.1	0.3	0.2	1.5	$37,500	11.9
Lyman	3,895	64.7	0.1	33.3	0.2	0.5	0.1	1.6	$32,028	19.4
Tripp	6,430	87.5	0.0	11.2	0.1	0.9	0.1	1.2	$36,219	15.9
Steele City Segment - Nebraska										
Keya Paha	983	99.6	0.0	0.4	0.0	3.9	0.0	0.4	$28,287	22.4
Rock	1,756	99	0.0	0.7	0.2	0.5	0.1	0.3	$29,917	17.7

Table 3.11-7 Environmental Justice Statistics in Affected Counties[1]

State / County[2]	Total Population 2000	Racial/Ethnic Categories (% of total population, 2000)[3] White	Black	Native American or Alaskan Native	Asian or Pacific Islander	Hispanic[4]	Other	Two or More Races	Median Family Income (1999)[5]	Families With Income Below the Poverty Level[6] (%) (1999)
Holt	11,551	98.9	0.0	0.5	0.2	0.7	0.2	0.4	$37,463	9.8
Garfield	1,902	98.8	0.0	0.2	0.1	1.0	0.4	0.5	$34,762	8.0
Wheeler	886	99.1	0.0	0.2	0.0	0.6	0.6	0.1	$33,750	14.4
Greeley	2,714	97.9	0.7	0.1	0.1	0.8	0.8	0.5	$34,159	11.9
Boone	6,259	99.2	0.0	0.0	0.0	0.9	0.3	0.3	$38,226	8.3
Nance	4,038	98.4	0.0	0.8	0.0	1.1	0.4	0.7	$38,717	10.2
Merrick	8,204	98.3	0.2	0.3	0.2	2.0	0.7	0.5	$39,729	7.0
Hamilton	9,403	98.4	0.2	0.1	0.2	1.1	0.5	0.6	$45,659	5.9
York	14,598	96.8	1.0	0.3	0.6	1.4	0.6	0.8	$44,741	6.0
Fillmore	6,634	97.8	0.2	0.4	0.1	1.7	0.8	0.7	$41,725	4.8
Saline	13,843	93.0	0.4	0.4	1.7	6.6	3.4	1.1	$44,199	6.4
Jefferson	8,333	98.4	0.1	0.4	0.2	1.3	0.5	0.4	$40,747	8.0*
Kansas – Keystone Cushing Extension Pump Stations										
Clay[7]	8,822	97.7	0.6	0.4	0.1	0.8	0.3	0.9	$41,103	6.8*
Butler[7]	59,482	94.9	1.4	0.9	0.4	2.2	0.7	1.7	$53,632	5.4
Oklahoma – Gulf Coast Segment										
Atoka	13,879	75.9	5.9	11.4	0.2	1.4	0.6	6.1	$29,409	15.7
Bryan	36,534	80.0	1.4	12.2	0.4	2.6	1.1	4.8	$33,984	14.0
Coal	6,031	75.2	0.4	17.3	0.3	2.1	0.7	6.1	$28,333	18.5
Creek	67,367	82.3	2.6	9.1	0.3	1.9	0.6	5.2	$38,470	10.8

Table 3.11-7 Environmental Justice Statistics in Affected Counties[1]

State / County[2]	Total Population 2000	Racial/Ethnic Categories (% of total population, 2000)[3]							Median Family Income (1999)[5]	Families With Income Below the Poverty Level[6] (%) (1999)
		White	Black	Native American or Alaskan Native	Asian or Pacific Islander	Hispanic[4]	Other	Two or More Races		
Hughes	14,154	72.8	4.5	16.2	0.2	2.5	1.0	5.4	$29,153	16.7
Lincoln	32,080	86.4	2.5	6.6	0.2	1.5	0.4	3.8	$36,310	11.1
Okfuskee	11,814	65.5	10.4	18.2	0.1	1.6	0.6	5.3	$30,325	17.3
Seminole	24,894	70.7	5.6	17.4	0.2	2.2	0.7	5.3	$30,791	16.7
Gulf Coast Segment - Texas										
Angelina	80,130	66.4	23.5	0.6	0.4	12.2	8.0	1.0	$39,505	12.4
Chambers	26,031	81.9	9.5	0.5	0.7	10.8	6.0	1.2	$52,986	8.3
Cherokee	46,659	74.3	16	0.5	0.5	13.2	7.4	1.3	$34,750	13.7
Delta	4,857	87.9	8.3	0.8	0.1	3.1	1.2	1.7	$37,925	14.6
Fannin	31,242	86.6	8.0	0.9	0.3	5.6	2.8	1.5	$42,193	9.9
Franklin	9,458	89.2	3.9	0.6	0.2	8.9	5.1	0.9	$37,064	12.5
Hardin	48,073	90.9	6.9	0.3	0.2	2.5	0.7	0.9	$42,890	8.8
Hopkins	31,960	85.1	8.0	0.7	0.2	9.3	4.6	1.4	$35,580	11.3
Jefferson	252,051	57.2	33.7	0.3	2.9	10.5	4.3	1.5	$42,290	14.6
Lamar	48,499	82.5	13.5	1.1	0.4	3.3	1.2	1.4	$38,359	12.8
Liberty	70,154	78.9	12.8	0.5	0.3	10.9	6.0	1.4	$43,744	11.1
Nacogdoches	59,203	75.0	16.7	0.4	0.7	11.2	5.7	1.4	$38,347	15.5
Polk	41,133	79.3	13.2	1.7	0.4	9.4	3.7	1.3	$35,957	13.3
Rusk	47,372	74.9	19.2	0.2	0.2	8.4	4.2	1.1	$39,185	10.9
Smith	174,706	72.6	19.1	0.4	0.7	11.2	5.7	1.4	$44.534	10.2

Table 3.11-7 Environmental Justice Statistics in Affected Counties[1]

State / County[2]	Total Population 2000	Racial/Ethnic Categories (% of total population, 2000)[3]							Median Family Income (1999)[5]	Families With Income Below the Poverty Level[6] (%) (1999)
		White	Black	Native American or Alaskan Native	Asian or Pacific Islander	Hispanic[4]	Other	Two or More Races		
Upshur	35,291	85.7	10.1	0.6	0.2	4.0	2.1	1.2	$38,857	12.3
Wood	36,752	89.1	6.1	0.6	0.2	5.7	2.9	1.1	$38,219	10.8
Houston Lateral -Texas										
Liberty	**See Liberty County in Gulf Coast Segment, above**									
Chambers	26,031	20,210	2,525	84	172	2,810	25	189	$52,986	11.0
Harris	3,400,578	1,432,264	619,694	7,103	173,026	1,119,751	4,499	40,489	$49,004	14.9

1 Affected areas are those counties where existing facilities exist, or counties where new pipeline facilities or surface disturbing activities associated with pipeline refurbishment are proposed.

2 States and counties are listed geographically from north to south as proposed project crosses the area.

3 Minority populations defined as black, Native American or Alaskan Native, Asian Pacific Islander, or Hispanic with percentages meaningfully greater than 1.5 times that of the minority population percentage in the general population of the surrounding area (i.e., the corresponding state) are identified with an asterisk (*).

4 Persons of Hispanic origin may be of any race, and for census-gathering purposes, Hispanic is a self-identified category. In this table individuals may have reported themselves as only Hispanic or in combination with one or more of the other races listed. This may result in the sum of percentages for all ethnic categories to be greater than 100 percent for any one county.

5 The median family income is defined here for a family of three. The poverty threshold is defined as the average threshold for a family of three and is not adjusted for regional, state, or local variations in the cost of living.

6 The percent of families with income below the poverty threshold in 2000, as defined by the Census Bureau for Federal statistical purposes, based on a family of three. Counties with a higher percent of the population below the poverty level than that occurring in the respective state are identified with an asterisk (*).

7 Construction in these counties will be related to pump stations only.

Source: Census 2000a.

Table 3.11-8 Environmental Justice Statistics in Affected Communities[1]

State / Community[2]	Proximity to Route (within x miles)	Racial/Ethnic Categories (% of total population, 2000)[3] White	Black	Native American or Alaskan Native	Asian or Pacific Islander	Hispanic[4]	Other	Two or More Races	Median Family Income (1999)[5]	Families With Income Below the Poverty Level[6] (%) (1999)
Steele City Segment										
MONTANA		**90.6**	**0.3**	**6.2**	**0.6**	**2.0**	**0.6**	**1.7**	**$40,487**	**10.5**
Nashua	2	92	0.3	5.5	0.3	2.2	0.3	1.5	$35,000	1.0
Circle	2	96.9	0.8	0.9	0.0	1.1	0.0	1.4	$36,354	16.2*
Baker	2	98.1	0.2	0.5	0.4	0.2	0.1	0.6	$42,375	7.7
SOUTH DAKOTA		**88.7**	**0.6**	**8.3**	**0.6**	**1.4**	**0.5**	**1.3**	**$43,237**	**9.3**
Buffalo	2	99.2	0.0	0.0	0.0	1.1	0.0	0.8	$37,000	7.0
Midland	2	99.4	0.0	0.0	0.0	0.0	0.0	0.6	$31,667	6.3
Draper	2	100	0.0	0.0	0.0	0.0	0.0	0.0	$26,250	16.7*
Winner	2	89.4	0.1	9.1	0.1	0.7	0.1	1.3	$38,472	10.7*
NEBRASKA		**89.6**	**4.0**	**0.9**	**1.3**	**5.5**	**2.8**	**1.4**	**$48,032**	**6.7**
Ericson	2	100	0.0	0.0	0.0	0.0	0.0	0.0	$35,500	0.0
Hordville	2	98.7	0.0	0.0	0.0	0.0	0.0	1.3	$40,000	10.9*
McCool Junction	2	99.2	0.0	0.0	0.0	1.6	0.5	0.3	$45,417	3.8
Exeter	2	98.2	0.0	0.3	0.1	0.6	0.0	1.4	$45,234	4.3
Milligan	2	98.1	0.0	1.0	0.0	0.3	0.0	1.0	$27,727	19.7*
Western	2	97.9	0.0	0.7	0.0	0.0	0.0	1.4	$41,250	2.6
Steele City	2	100	0.0	0.0	0.0	0.0	0.0	0.0	$32,500	8.3*
KANSAS		**86.1**	**5.7**	**0.9**	**1.7**	**7.0**	**3.4**	**2.1**	**$49,624**	**6.7**
Winfield	0.5	88.1	3.3	1.1	3.7	4.7	1.7	2.1	$44,539	9.9*
Arkansas City	2	87.2	4.5	2.7	0.6	4.5	1.9	3.0	$39,962	12.4*
Augusta	2	96.1	0.2	0.8	0.4	2.6	0.7	1.9	$51,886	4.1
Douglas	2	96.2	0.3	1.6	0.2	1.7	0.5	1.2	$53,991	6.2
Wakefield	2	95.9	0.8	1.1	0.1	1.2	0.6	1.4	$50,256	4.2
Hope	2	98.1	0.8	0.5	0.3	0.3	0.0	0.3	$32,813	4.8
Green	2	96.6	0.7	2.7	0.0	1.4	0.0	0.0	$29,167	5.3
OKLAHOMA		**76.2**	**7.6**	**7.9**	**1.5**	**5.2**	**2.4**	**4.5**	**$40,709**	**11.2**
Morrison	2	89.2	0.3	2.8	0.5	4.2	2.7	4.6	$35,417	13.5*
Marland *	2	48.9	0.0	38.6	0.0	10.0	3.2	9.3	$25,625	31.0*
Gulf Coast Segment										

Table 3.11-8 Environmental Justice Statistics in Affected Communities[1]

State / Community[2]	Proximity to Route (within x miles)	Racial/Ethnic Categories (% of total population, 2000)[3]							Median Family Income (1999)[5]	Families With Income Below the Poverty Level[6] (%) (1999)
		White	Black	Native American or Alaskan Native	Asian or Pacific Islander	Hispanic[4]	Other	Two or More Races		
Stroud (Creek County)	2	83.7	3.7	8.4	0.5	1.5	0.5	3.2	$31,742	12.3*
Paden	2	76.7	0.0	15.7	0.0	0.9	0.0	7.6	$31,250	7.1
Boley *	2	35.6	54.7	5.0	0.1	3.1	1.5	3.1	$27,500	25.0*
Wewoka *	2	51.0	19.9	21.4	0.4	2.4	1.0	6.2	$27,130	26.6*
Allen (Hughes/Pontotoc)	2	77.3	0.4	14.3	0.1	2.0	0.9	6.9	$26,845	16.6*
Atoka	2	72.9	11.5	10.3	0.3	0.9	0.1	5.0	$22,234	19.1*
Tushka	2	72.5	0.0	19.7	0.0	2.0	0.3	7.5	$26,250	19.8*
Caney	2	80.9	0.0	14.6	0.5	0.0	1.0	4.0	$17,045	25.0*
TEXAS		**71**	**11.5**	**0.6**	**2.8**	**32**	**11.7**	**2.5**	**$45,861**	**12.0**
Arp	0.5	95.3	3.2	0.1	0.0	2.6	0.4	0.9	$38,807	4.2
Beaumont *	0.5	46.4	45.8	0.2	2.5	7.9	3.5	1.5	$40,825	16.4*
Port Arthur *	0.5	39.0	43.7	0.5	5.9	17.5	8.9	2.1	$32,143	22.9*
Central Gardens	0.5	96.1	0.6	0.3	0.5	4.3	1.2	1.3	$60,096	3.9
Nederland	0.5	93.5	0.9	0.3	2.0	6.3	2.0	1.2	$51,525	5.5
Tira	2	96.4	0.0	0.0	0.0	0.8	2.0	1.6	$47,639	4.7
Winnsboro (Franklin/Wood)	2	85.7	8.9	0.8	0.7	5.0	2.7	1.1	$37,286	11.3
Big Sandy	2	81.8	12.9	0.4	1.2	3.5	3.0	0.9	$34,107	16.4*
Reklaw	2	89.7	0.0	0.0	0.0	7.8	5.2	5.2	$38,250	6.5
Wells	2	72.4	18.7	0.3	0.0	9.1	6.5	2.1	$26,563	20.2*
Hudson	2	74.5	20.8	0.3	0.2	4.0	2.9	1.4	$37,292	12.1*
Diboll *	2	53.7	24.1	0.5	0.2	37.3	19.4	2.2	$31,524	24.0*
Corrigan *	2	48.1	42.2	0.2	0.0	14.9	8.8	0.6	$24,830	30.3*
China	2	71	24	0.4	0.9	4.6	2.8	0.9	$41,500	12.7*
Port Neches	2	94.8	0.9	0.5	1.6	5.1	1.2	1.1	$53,729	4.4
TEXAS (Houston Lateral)										
Mont Belvieu	0.5	91.0	4.3	0.7	0.4	6.5	2.5	1.2	$64,808	6.4
Barrett *	0.5	8.6	86.6	0.3	0.0	6.2	2.9	1.6	$35,074	23.1*
Houston *	0.5	49.3	25.3	0.4	5.4	37.4	16.5	3.1	$40,443	16.0*
Hardin	2	98.5	0.5	0.0	0.1	4.1	0.7	0.1	$47,500	6.9

Table 3.11-8 Environmental Justice Statistics in Affected Communities[1]

State / Community[2]	Proximity to Route (within x miles)	Racial/Ethnic Categories (% of total population, 2000)[3]							Median Family Income (1999)[5]	Families With Income Below the Poverty Level[6] (%) (1999)
		White	Black	Native American or Alaskan Native	Asian or Pacific Islander	Hispanic[4]	Other	Two or More Races		
Liberty	2	75.5	13.1	0.4	0.7	14.8	9.2	1.0	$41,369	12.4*
Highlands	2	90.2	1.6	0.5	0.4	13.0	5.3	2.0	$49,655	6.7
Channelview *	2	63.1	13.0	0.5	2.1	37.1	18.3	2.9	$45,638	11.5
Sheldon *	2	78.9	2.7	0.8	0.1	34.7	14.6	2.9	$45,219	9.0

3.12 Public Safety

A risk assessment is being prepared for the Project and will be filed with the DOS in January 2009.